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Personal Network Correlates of Alcohol, Cigarette, and Marijuana Use Among Homeless Youth

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Abstract

Background—Youth who are homeless and on their own are among the most marginalized individuals in the United States and face multiple risks, including use of substances. This study investigates how the use of alcohol, cigarettes, and marijuana among homeless youth may be influenced by characteristics of their social networks.

Methods—Homeless youth aged 13–24 were randomly sampled from 41 service and street sites in Los Angeles County (N = 419). Predictors of substance use were examined using linear regression analysis (for average number of drinks and average number of cigarettes per day) and negative binomal regression analysis (for frequency of past month marijuana use).

Results—Youth with more substance users in their networks reported greater alcohol, cigarette, and marijuana consumption regardless of whether these network members provided tangible or emotional support. Marijuana use was more frequent for youth who met more network members through homeless settings, but less frequent among those who met more network members through treatment or AA/NA. Greater alcohol use occurred among youth who met more network members through substance use-related activities. Youth having more adults in positions of responsibility in their networks consumed less alcohol, and those with more school attendees in their networks consumed less alcohol and cigarettes.

Conclusions—Findings highlight the importance of social context in understanding substance use among homeless youth. Results also support the relevance of network-based interventions to change social context for substance using youth, in terms of both enhancing pro-social influences and reducing exposure to substance use.

Keywords

homeless youth; social networks; alcohol use; drug use

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1. Introduction

1.1. Homeless youth and substance use

Youth who are homeless and on their own are among the most marginalized individuals in the United States. Included in this population are runaways who leave their homes with the consent of parents or guardians, youth who are forced out of their homes ("throwaways"), youth in the foster care system or other social service systems who have problems associated with their placements, and youth who are in families that become homeless (Walters, 1999). The number of youth who experience homelessness in a given year in the United States may be as high as 1.6 million (Toro et al., 2007) to 1.7 million (Hammer et al., 2002; Toro et al., 2007). Homeless youth ages 13 through 24 who are on their own and emancipated are the focus of the current study.

Homeless youth in Los Angeles and elsewhere face multiple problems, including increased risk of using substances (Rice et al., 2005). Alcohol, tobacco, and marijuana are the three substances most commonly used by these youth (Greene et al., 1997; Rosenthal et al., 2008; Thompson, 2004).. In a study involving more than 600 homeless youth in Los Angeles, 57% of those newly homeless and 70% of those who had experienced longer-term homelessness had used alcohol in the past 3 months, and 57% and 58% of these youth, respectively, had used marijuana during that time period (Rosenthal et al., 2008). Another study found that approximately 66% of homeless youth in Los Angeles meet DSM criteria for substance abuse (Kipke et al., 1997). In a national sample of homeless youth utilizing emergency shelter services, more than three-fourths had smoked cigarettes (Thompson, 2004). Among the larger population of adolescents with homes, alcohol, cigarettes, and marijuana are also more frequently used than other substances, but rates of use of all substances are notably higher among homeless than housed youth (Eaton et al., 2006; Kipke et al., 1993; McMorris et al., 2002).

Alcohol, tobacco, and marijuana can each have significant negative health and behavioral consequences. The impacts of alcohol use include, for example, impaired judgment and decision making that may lead to accidental injuries and to risky sexual activity resulting in sexually transmitted infections including HIV (NIAAA (National Institute of Alcohol Abuse and Alcoholism), 2007). The role of tobacco use in respiratory illness and risk for a variety of cancers is widely known (NIDA (National Institute on Drug Abuse), 2009); prevention or early intervention with youth may circumvent a lifetime of tobacco addiction and increased risk for cancer and respiratory disease. Marijuana use has been associated, for example, with impaired decision-making and short-term memory limitations that affect performance in school and on the job (NIDA (National Institute on Drug Abuse), 2005). Through their impacts on judgment and decision-making and thus risk behaviors, alcohol and marijuana use may also place youth at risk of infection with the Hepatitis B and C viruses(Nyamathi et al., 2005). Adolescent alcohol, tobacco, and marijuana use have additionally been found to be associated with later use of other drugs such as cocaine (Duan et al., 2009; Pentz and Li, 2002). The frequency with which alcohol, tobacco, and marijuana are used by homeless youth and the negative consequences associated with use of these substances demand an increased understanding of risk factors for use, and, ultimately, improved prevention and early intervention efforts. We focus on alcohol, tobacco (i.e., cigarette), and marijuana use in this study.

1.2. Social context of alcohol, tobacco and marijuana use

The risk amplification model (McMorris et al., 2002; Whitbeck et al., 1999) and ecological theories of behavior (Bronfenbrenner, 1979; Sallis et al., 2006; Stokols, 1992) provide useful frameworks for explaining high-risk behaviors such as substance use among homeless

youth. The risk amplification model posits that youth may begin a negative developmental trajectory that results in homelessness. While homeless, they form ties with deviant groups that may use alcohol and drugs. Affiliations with deviant peers then influence youth's own involvement in risky behaviors including substance use (Tyler et al., 2000). While the risk amplification model highlights the potential influence of deviant peers, ecological theories call more broadly for increased attention to the social contexts in which behaviors are shaped (Wenzel, Green et al., 2009; Williams and Latkin, 2007). Ecological theories support the notion that a potentially diverse network of individuals – including but not limited to deviant peers – may exert both risky and protective influences on substance use and thus represent a critical adjunct to the risk amplification model in guiding an understanding of homeless youth's substance use. Social context, specifically the potential influence of youth's possibly diverse personal networks, remains under-researched in efforts to understand the risk behaviors of homeless youth.

1.3. Personal networks and substance use

In studies of non-homeless youth, one of the most consistent predictors of substance use is whether friends or peers engage in substance use (Duan et al., 2009; Epstein et al., 1995; Hawkins et al., 1992). Peer influences on substance use may refer to both the youth's perceptions of actual use by peers as well as perceptions of social norms more generally that are supportive of substance use (Duan et al., 2009). Among middle school and high school youth, perceived peer norms have been found to predict various types of substance use (Ellickson et al., 2004; Tucker et al., 2008). Research conducted with Black and Hispanic youth living in inner city areas has demonstrated that youth's perceptions of peer smoking and alcohol use (Epstein et al., 1999), as well as marijuana use (Epstein et al., 1995), were associated with the youth's own behaviors.

Research on the social networks of homeless youth similarly suggests that peers and other individuals may influence these youth's substance use and other risk behaviors. A greater density of drug using peers in homeless youth's networks, for example, is associated with youth's own substance use (Rice et al., 2005). Homeless young adults in a study by (Tyler, 2008) reported more behaviors associated with substance use (e.g., sold drugs, used drugs) when they used illicit drugs with at least one person in their network. In contrast to these potentially harmful influences of networks on the substance use behaviors of homeless youth, the presence of family members and peers who engage in pro-social behaviors such as regularly attending school may have a protective effect against substance use (Ennett et al., 1999; Rice et al., 2007; Tyler, 2008).

Emerging evidence points to diversity in the networks of homeless persons and thus multiple sources of potential influence on behaviors (Tucker et al., 2009; Wenzel et al., under review). Homeless youth's networks are comprised of peers, relatives, adult service providers, and other individuals, each of whom may engage in (or be perceived by youth to engage in) activities that are risky or protective to health (Wenzel et al., under review). Studies have typically not examined the composition or structure of youth's personal networks beyond a small number of individuals, typically friends or peers, in association with substance use. In two studies examining networks, for example, youth were asked to identify only two individuals with whom they frequently interacted (Ennett et al., 1999; Tyler, 2008). A diverse array of network members including peripheral and weaker ties may have considerable influence on behaviors (Latkin et al., 2003; Latkin et al., 1995). Diversity in homeless youth's networks, and thus multiple potential sources of influence, call for a more comprehensive investigation of homeless youth's networks in relation to substance use. Obtaining an understanding of the larger social context in which an individual's risk behaviors are shaped may enhance the effectiveness of interventions to address these behaviors (Logan et al., 2002; Williams and Latkin, 2007).

There has been limited research on the potential influence of support received from network members on homeless youth's substance use. Without financial and other resources from families, homeless youth are particularly dependent on support from others given their need to survive in difficult, dangerous, and stressful circumstances (Gwadz et al., 2009). Support is instrumental in stress reduction and thus may reduce one's propensity of engaging in health risk behaviors (Cohen and Wills, 1985; Tucker et al., 2005; Uchino et al., 1996). The possible influence of support on substance use has not been consistent, however. Among adult homeless women, social support has predicted reduced frequency of marijuana use (Tucker et al., 2005). In another study examining the social context of risk behaviors, however, the percentage of network members homeless women perceived to be available to provide support was not associated with their use of alcohol or marijuana (Wenzel, Green et al., 2009). Although Johnson and colleagues (2005) (Johnson et al., 2005) found that the presence of a family member who provides both instrumental and emotional support may buffer against homeless youth's alcohol consumption, evidence for a protective effect of social support against youth substance use is nevertheless also mixed (Tyler, 2008).

Lack of clarity in the possible importance of social support may be due to multiplexity, or overlap, in risky and supportive elements of homeless youth's networks. A network member may consume alcohol or drugs but also be a provider of valuable tangible or intangible resources to the youth. Such a network member may be more influential in terms of enhancing the likelihood of a youth's substance use than a network member who uses but is not additionally a provider of support. In a study involving homeless women, those who received social support from substance-using family, friends, and partners exclusively were themselves more likely to be current users of substances (Nyamathi et al., 2000). Substance using network members on whom the homeless youth rely for tangible or intangible assistance may therefore be particularly influential. Multiplexity has not previously been examined in homeless youth's networks to understand risky behaviors such as substance use.

1.4. The present study

The goal of this study is to understand how use of alcohol, cigarettes, and marijuana among homeless youth may potentially be influenced by social context; that is, youth's personal networks and the support they receive in their networks. Attention to the social context is consistent with the risk amplification model (McMorris et al., 2002; Whitbeck et al., 1999) and particularly ecological theories of behavior (Bronfenbrenner, 1979; Sallis et al., 2006; Stokols, 1992). A better understanding of the networks in which homeless youth are embedded may inform more effective interventions to curb unhealthy behaviors and encourage healthy alternatives. We expect that characteristics of homeless youth's personal networks will be valuable in understanding alcohol, tobacco and marijuana use. Specifically, we hypothesize that homeless youth's alcohol, tobacco, and marijuana use will be more frequent with greater numbers of substance users in their networks. We also hypothesize that the association between homeless youth's substance use and the number of substance users in their networks will be greater when these substance users are perceived to be supportive.

2. Methods

2.1. Study participants

Participants in this study were 419 homeless youth in Los Angeles County between the ages of 13 and 24 who were randomly sampled from 41 shelters, drop-in centers, and street sites (e.g., street corners, highly populated blocks, "hang out" areas including parks and alleys) where homeless youth congregate. Informed by definitions of homeless youth used in other studies (Greene et al., 1997; Robertson, 2004; Witkin et al., 2005) youth were eligible if

they a) were between the ages of 13–24; b) were not currently living with a parent or guardian; c) were not getting most of their support for food and housing from family or a guardian; d) spent the previous night in a shelter, outdoor or public place, hotel or motel room rented with friends (because of no place else to go), or other place not intended as a domicile; and e) were English speaking.

Interviews were conducted over a period of ten months between October 2008 and August 2009. We approached 582 youths in total. Of those, 7 refused to be screened, 129 screened ineligible, and 446 screened eligible. The percentage of youth approached that agreed to be screened is 98.8%. Of the 446 youth that screened eligible, 437 completed the interview. Of the 9 youth who screened eligible but did not complete the interview, 4 refused the interview and 5 were break-offs. Of the 437 youth who completed interviews, 18 were later found to be ineligible because two were older than 24 years of age, one did not meet the study definition of homelessness, and 15 had completed the interview previously. Eighteen youth were therefore excluded, leaving a study sample size of 419 and a final response rate of 97.89%. Individual, computer-assisted face-to-face structured interviews were conducted by trained male and female interviewers with interviews lasting an average of one hour and 40 minutes. Youth were paid $25 for their participation in the interview. The research protocol was approved by the institutional review board of RAND and a Certificate of Confidentiality was obtained from the U.S. Department of Health and Human Services.

2.2. Study design

We recruited a probability sample of homeless youth from shelters, drop-in centers, and street venues in the study area. Because a list or sampling frame of all the homeless youth in the study area is not available, we adopted a multi-stage design. We first developed a list of sites used by homeless youth (i.e., shelters, drop-in centers, and street venues) and then sampled youth within the selected sites. The first stage of the adopted multi-stage design consisted of the selection of sites. We developed two sampling frames: one of the eligible service sites (shelters and drop-ins) and one for the street venues in the study area. The first sampling frame was developed using local directories of services for homeless persons. Service sites were considered eligible if they were located in the study area and the majority of their clientele was ages 13 to 24 and English speaking. Service sites not limited to that age group were eligible if they had a specific program geared toward youth. In addition, for short-term transitional housing programs the average length of stay had to be at most one year. Our final list of service sites consisted of 22 eligible sites: 15 shelters and 7 drop-in centers. All the eligible service sites in the study area that agreed to participate in the study were selected with certainty; therefore, the sites can be considered strata. The second sampling frame was developed by the research team with the help of service providers and outreach agencies. The research team ultimately identified 19 street venues in the study area where homeless youth congregate and “hang out”. All of these street sites were included in the study and hence they are considered strata. All the sites were investigated extensively with the major purpose of obtaining an estimate of the average number of youth served daily by the service sites and the average number of youth that “hang out” at the street venues in a given day. This information was used to assign a quota for the number of completed interviews to be achieved at each site which was approximately proportional to the size of a site. The second stage of the adopted sampling design consisted of drawing a probability sample of homeless youth from the 41 study sites. Strategies specific to the type of sites were developed to randomly select the youth to be approached, screened and interviewed.

The adopted sampling design deviates from a proportionate-to-size stratified random sample (where a constant proportion of the population is sampled from every site) because of changes in the sampling rates during the fielding period, possible differential response rates of youth across sites, and because some youth visit shelters, drop-ins and street venues more

frequently than other youth. This last factor means that some youth are more likely than others to be included in the sample for a given site. We accounted for the differential frequency of use of sites by assessing, during the interview, how often a respondent had gone to a shelter, drop-in or street venue in the study area during the past 30 days and used this information to correct the respondents' sampling probability. We developed and used sampling weights to correct for the departures from a proportionate-to-size stratified random sample and hence the potential bias due to the differential inclusion probabilities.

2.3. Measures

2.3.1. Substance use—Alcohol use, cigarette use, and marijuana use were assessed for a past 30 day period using items from the Youth Risk Behavior Surveillance System (Centers for Disease Control and Prevention, 2008). Youth were first asked on how many days they had at least one drink of alcohol, and were subsequently asked how many drinks they typically had on those days when they drank alcohol. A "drink" was defined for them as a can of beer, a glass of wine, or a shot of hard liquor. To assess cigarette smoking, youth were asked on how many days they smoked cigarettes, and were then asked how many cigarettes they typically smoked on those days. Youth were asked how many times they used marijuana or hashish during the past 30 days. The maximum valid response for number of days of alcohol and cigarette use was 30. No ceiling was imposed on responses to the number of times marijuana was used. For alcohol and cigarette use, respectively, we computed the average number of drinks per day and average number of cigarettes per day during the past 30 days.

2.3.2. Personal network characteristics—We focus on personal networks which encompass the ties surrounding each homeless youth. We used established procedures for conducting personal network interviews (McCarty, 2002; McCarty et al., 1997) and our experiences in a prior study of homeless women (Tucker et al., 2009; Wenzel, Green et al., 2009) to develop the instrument. After respondents provided information about their own attitudes and behaviors, we asked them to provide the first names of 20 individuals ages 13 or older that they knew, who knew them, and that they had contact with sometime during the past three months. Contact could be face-to-face, by phone, mail or through the internet (e.g., e-mail). We used a general name generator (i.e., name anyone you have had contact with) rather than a specific name generator (e.g., name family, friends) to allow for identification of a greater diversity of network members (alters). We constrained network size to be the same (20 alters) across respondents to maximize comparability of network structure measures across respondents (Mehra et al., 2001). Twenty alters has been shown to capture structural and compositional variability present in personal networks (McCarty et al., 2007). We then asked a series of questions about the alters, their behaviors, and their relationship with the respondent.

Characteristics of networks in this study are measured in terms of the types of alters in the network, how respondents met alters, the behaviors of alters, support from alters, and the overall structure of each respondent's personal network. Types of alters that we inquired about form mutually exclusive categories: individuals who are relatives; non-relative sex partners; adults in positions of responsibility; and other individuals who are not relatives, sex partners, or adults in positions of responsibility. For all alters other than relatives, we asked how the respondent met these individuals. Responses included, for example, in a shelter, drop-in center, transitional living facility, group home or other service site; through a job or school; religious organizations; AA or NA participation; the criminal justice system; foster care; a party or bar; or through the respondents' own or others' alcohol or drug use. We derived the category, "adults in a position of responsibility," in the following manner: If a respondent indicated that he or she met an individual through a shelter or other service site,

through a job or school, foster care, through a religious organization, through AA/NA, or through the criminal justice system, we asked, for each individual named, whether that individual was a service provider (e.g., mental health or substance abuse counselor, doctor, nurse, social worker, case manager, teacher, boss, priest or minister, AA/NA group leader, probation officer).

Behaviors of the 20 named alters were assessed by asking whether they thought each had used alcohol to the point of being drunk, had used drugs of any kind, had attended school, and had been employed. To assess emotional and tangible support, we asked respondents which of the 20 alters could be counted on to really care about them no matter what, and which could be counted on to lend them money, give them food, or give them a place to stay without asking for anything in return.

We derived multiplexity variables to examine whether having drug or alcohol using alters who also provided support would be associated with more frequent substance use among youth than having drug or alcohol using alters who did not provide support. We derived these variables by summing, among the twenty alters named by each respondent, the number of alters who both drank alcohol and provided emotional or tangible support, drank but provided no support, did not drink but provided support, and neither drank nor provided support to the respondent. Variables for drug using and non-using alters were similarly created.

Network structure was operationalized as density, the number of connections (e.g., friendships, relationship ties) among alters, which has been associated with substance use (Latkin et al., 1995; Rice et al., 2007) in previous research. Density is an index varying between 0 and 1 that represents the proportion of ties among a group of alters relative to the total number of possible ties. Measures of network density were calculated among all of a respondents' alters and among those alters who were reported by the respondents as being likely to drink to intoxication or to use drugs, two behaviors representing two risky sub-groups of the network. To investigate these sub-groups of alters, we calculated structural measures including only those individuals identified as having one of these risk factors.

2.3.3 Background characteristics—We adjusted for background characteristics of the youth in our consideration of social context. These included gender, age (continuous), sexual orientation, homeless history (age first left home, ever returned home after leaving for the first time), years of education (less than 12 years vs. at least 12 years or GED), race and ethnicity, employment (full- or part-time employed versus unemployed), and time in jail or juvenile detention. Because incarceration may be a marker for risky behaviors (Kim et al., 2002), we assessed incarceration history by asking the youth how many nights in their lifetime they had spent in jail, prison, or juvenile lock-up.

2.4 Analyses

Departures from proportionate-to-size random sampling due to changes in the sampling rates during the fielding period, differential non-response rates across sites, and differential rates of visits to shelters, drop-ins and street venues among homeless youth require the use of weights to adjust estimates and correct for potential bias due to respondents' differential inclusion probabilities. All analyses incorporate these weights and account for the modest design effect that they induce, using the linearization method (Skinner, 1989) to correctly compute standard errors. To understand the association of social context with homeless youth's alcohol, cigarette, and marijuana use, we used linear regression to model the average number of drinks consumed per day and the average number of cigarettes smoked per day. We used negative binomial regression to model the number of times a youth used marijuana during the past 30 days (McCullagh and Nelder, 1989).

To build each regression equation, we examined the bivariate association of each of the three substance use outcomes with each personal network characteristic. Personal network characteristics associated with any of the three substance use outcomes at at $p < .10$ in bivariate analyses were included in multivariate models for all three substance use outcomes (Hosmer and Lemeshow, 1989). Background characteristics (i.e., age, gender, race and ethnicity, education, sexual orientation, incarceration history, employment, homeless history) were included in all models as control variables regardless of bivariate association with the three substance use outcomes. Because the number of substance using alters was highly correlated with the density of substance using alters, we initially excluded density from each regression equation and then examined it in subsequent equations that excluded the number of substance using alters. Since the multiplexity variables (e.g., number of drug using alters who provide support) cannot be put in the same model with the variables from which the multiplexity variables are derived (e.g., number of drug using alters, number of alters providing support), we first fitted models containing only the main effects (e.g., number of drug using alters, number of alters providing support) and then fit separate models that assessed the effect of the multiplexity variables. To examine multiplexity, we used t-tests to assess whether having substance using alters who also provide support is associated with greater substance use among homeless youth than having alters who use substances but do not provide support. Conducting such a test is equivalent to testing whether the linear combination of coefficients associated with the three multiplexity variables (i.e., the number of alters who both use substances and provide support, the number who do not use substances but provide support, the number who use substances but provide no support) is significantly different from zero.

3. Results

3.1. Descriptive characteristics

3.1.1. Individual characteristics and substance use—As shown in Table 1, youth who identified as White were the largest racial/ethnic group represented in our sample (34%), followed by Black youth (24%) and Hispanic/Latino youth (20%). The majority (63%) of homeless youth in this study were male. More than two-thirds of the sample had previously spent time in jail or juvenile detention, and almost half (48%) reported that they had not returned to their home or guardian since the first time they departed. During the past 30 days, on average, youth reported drinking 2.61 (SD = 8.27) alcoholic beverages per day, smoking 8.64 (SD = 12.17) cigarettes per day, and using marijuana 58 different times (mean = 57.50, SD = 140.84). Rates of any use during the past 30 days (not depicted in Table 1) were 68% for alcohol, 72% for cigarettes, and 66% for marijuana.

3.1.2. Personal network characteristics—In terms of the types of alters who made up the homeless youth's personal networks, those who were neither relatives, sex partners, nor adults in positions of responsibility made up the largest category among the 20 alters (mean = 14.73, SD = 3.96). Relatives were a distant second at a mean of 3.61 (SD = 3.80), followed by an average of 1.66 (SD = 2.12) sex partners. On average, youth reported having fewer than one adult in a position of responsibility (mean = 0.55, SD = 1.40) in their networks. Youth met an average of 7.13 (SD = 6.51) of their non-relative alters in shelters, drop-ins, or on the street. (Adults providing services in such settings were excluded from this count.) On average, about half of the 20 alters named by youth were reported to use alcohol to the point of being drunk (mean = 8.79, SD = 7.92) or to use drugs (mean = 9.99, SD = 8.02). Conversely, a smaller number of alters, between 4 and 6, were reported to regularly attend school (mean = 4.29, SD = 4.90) or to have a regular or steady job (mean = 6.39, SD = 5.40). In terms of support available from the network, approximately one-third (between 6 and 7) of the 20 alters, on average, were perceived to care about the youth or to

be available for tangible assistance. In general, there were relatively fewer alters who were both supportive of the youth and also drinkers or drug users than there were alters who were non-supportive. Youth's personal networks had an overall average density of 0.16, which corresponds to networks in which 16% of all possible ties among alters are present. Network density was similar among alcohol users (17%) and drug users (16%).

3.2. Multivariate modeling: Predictors of alcohol, cigarette, and marijuana use

Table 2 displays results of the multivariate linear regression modeling of the average number of drinks and the average number of cigarettes that youth consumed per day in the past 30 days, and results of the negative binomial regression modeling of the number of times youth used marijuana in the past 30 days. Coefficients for predictor variables in linear and negative binomial regressions are interpreted in terms of magnitude and directionality of association with the outcome variables. Findings are statistically significant if they achieve $p < .05$.

In terms of types of alters, consuming fewer drinks per day was significantly associated with having more adults in positions of responsibility in their networks (beta = −0.305, SE = 0.148); however, the numbers of relatives and sex partners in their networks were not associated with youth's cigarette, alcohol, or marijuana use. How youth reported meeting alters was also predictive of their substance use. Alcohol consumption was positively associated with meeting alters through substance use (beta = 0.788, SE = 0.170), whereas marijuana consumption was negatively associated with meeting alters through treatment or self-help groups such as AA/NA (beta = −0.572, SE = 0.287). Meeting more alters through homeless settings was associated with greater consumption of marijuana (beta = 0.043, SE = 0.020), but not cigarettes or alcohol.

Regarding the behavior of alters, more frequent cigarette smoking (beta = 0.395, SE = 0.092), alcohol (beta = 0.118, SE = .060), and marijuana (beta = 0.143, SE = 0.018) was found among youth who had a larger number of substance users in their networks. Less frequent cigarette smoking (beta = −0.505, SE = 0.107) and alcohol consumption (beta = −0.133, SE = 0.061) were reported by youth who had a larger number of school attendees in their network, although there were no significant associations between youth substance use and the number of employed individuals in their network. Density in the subgroup of alcohol and drug using alters was not a significant predictor of substance use. Neither emotional nor tangible support met the $p < .10$ criterion in bivariate association to any of the three substance use outcomes and thus neither was included in multivariate analyses.

Results of multivariate regressions in Table 2 show that homeless youth's background characteristics were also important to understanding their alcohol, cigarette, and marijuana use. Greater daily cigarette consumption was associated with younger age (beta = −0.496, SE = 0.232) and more time spent in jail or detention (beta = 1.629, SE = 0.646). Both cigarette consumption (beta = −4.297, SE = 1.158; beta = −3.682, SE = 1.224) and drinking (beta = −2.124, SE = 0.722; beta = −2.032, SE = 0.711) were less frequent among Black and Hispanic youth, respectively, compared to other youth. Less frequent drinking was additionally associated with being gay, lesbian, bisexual or transgender as opposed to being straight (beta = −1.843, SE = 0.619). Less frequent marijuana use occurred among homeless youth who left homes at younger age (beta = − 0.309, SE = 0.099).

As shown in Table 3, results of multivariate analyses to understand multiplexity showed that having a greater number of substance using alters in the network was positively associated with cigarette and marijuana consumption, both when substance using alters were also available to provide support (cigarettes: beta = 0.330, SE = 0.143; marijuana: beta = 0.145, SE = 0.025) and when they were not available to provide support (cigarettes: beta = 0.449, SE = 0.109; marijuana: beta = 0.135, SE = 0.019). T-tests assessing whether having

substance using alters who also provide support is associated with more frequent substance use among homeless youth than having alters who use substances but do not provide support were not significant. Alters' substance use was related to youth's substance use regardless of alter support.

4. Discussion

Consistent with the risk amplification model (McMorris et al., 2002; Whitbeck et al., 1999) and ecological theories of health behavior (Bronfenbrenner, 1979; Sallis et al., 2006; Stokols, 1992), results indicate that the social context surrounding homeless youth is important in understanding their use of alcohol, cigarettes, and marijuana. In multivariate models that controlled for background characteristics, greater past month use of all three substances was reported by youth who had a greater number of substance-using individuals in their networks. Substance use was also greater when youth had met more of their network members through substance use (in the case of alcohol) or through shelters, drop-in centers, or on the street (in the case of marijuana). The risk amplification model posits the important role of affiliations with deviant peers in influencing youth's involvement in behaviors such as substance use (Tyler et al., 2000). The findings also argue for continued attention to the diversity of networks in terms of not only risky but also protective influences on health behavior, as indicated by ecological theories. We found that less frequent cigarette and alcohol use was reported by youth having greater numbers of school attendees or adults in positions of authority, and that less marijuana use was reported by youth who had met more individuals through treatment or self-help groups. The number of sex partners a youth reported was not associated with substance use. It may be that the number of sex partners who are using substances is more influential than the number of sex partners regardless of whether they use substances; the influence of substance using sex partners might have been exerted through the variable representing the number of substance using alters overall.

Previous research involving non-homeless adolescents has demonstrated significant associations between peer substance use (both actual and perceived) and youth substance use (Duan et al., 2009; Hawkins et al., 1992). It cannot be definitively argued based on the results of this study that homeless youth's affiliations with substance users increased their consumption of alcohol, cigarettes and marijuana. Similarly, we cannot know for certain that peers attending school, adults in positions of responsibility, and individuals met through treatment or self-help groups decreased consumption among homeless youth. An alternative explanation for these findings is that youth select alters with whom to affiliate based on their own substance use and characteristics of the alter. For example, homeless youth who drink may seek out other drinkers with whom to affiliate. A number of studies directly testing peer influence vs. selection effects on youth substance use have found evidence for both processes (e.g., (Bohnert et al., 2009; Go et al., 2010; Hall and Valente, 2007). Social selection cannot be discounted, but developmental stage and circumstances may make homeless youth especially subject to normative and attitudinal influences from others.

Reported availability of tangible and emotional support from alters was not associated with homeless youth's alcohol, tobacco, or marijuana use. Furthermore, the availability of support from substance using alters did not seem to enhance the influence of substance-using alters on youth's own substance use behaviors above and beyond the influence of substance using but non-supportive alters. Among adult homeless women, those who received social support from substance-using family, friends, and partners exclusively were themselves more likely to be current substance users (Nyamathi et al., 2000). Although the multiplexity hypothesis was not supported in this study, further research is warranted to determine whether support makes a difference for youth depending on whether the substance-using alter is a partner, a family member, or other individual. Homeless youth's

reduced marijuana use when they reported a greater number of affiliations with individuals in self-help groups suggests the importance of understanding specific kinds of support as well as the providers of support. Despite the inconclusive results of this and other studies regarding the role of support in substance use, previous studies have emphasized the important role of supportive resources to homeless youth's survival (Gwadz et al., 2009).

Understanding how and to what extent characteristics of networks are associated with homeless youth's alcohol, cigarette, and marijuana use is crucial in determining how the social context might be reshaped to benefit these youth. Findings from this study suggest that disassociation from alcohol and drug-involved networks and increased associations with students in school and with counselors, teachers, and other adults in positions of responsibility may reduce the risk of alcohol and cigarette use. As noted previously, the specific support derived from affiliations with self-help groups may be protective of marijuana use. Recommendations of disassociation from persons having harmful influences and building affiliations with persons having prosocial influences are a hallmark of substance abuse treatment. Even intensive substance treatment alone, however, may be insufficient in reducing substance use in the long term, perhaps because restructuring of social context through treatment does not always occur, is not comprehensive, or because restructured affiliations are not sustained. Findings from an evaluation of a widely available, community-based residential alcohol and drug treatment intervention for adolescents indicated no treatment effects 72 to 102 months after intake (Edelen et al., In press). The lack of sustained treatment effects do not diminish the importance of treatment and its benefits for adolescent substance users in the shorter term (see (Edelen et al., In press)), but these findings do suggest the importance of enhanced treatment and additional resources for youth particularly if they are homeless.

Social bonding, building efficacy and coping skills, and involvement in alternative rewarding activities have been identified as key to substance use remission (Moos, 2007). Favorably changing social context (Bantchevska et al., 2008) and building the additional attributes deemed critical to substance use remission might be achieved in part through structural solutions including stable housing and gainful education and employment opportunities. Social development strategies such as social enterprises, which provide vocational training, small business skills, clinical mentorship and linkages to treatment and other services, are innovative emerging approaches that may hold promise for homeless youth with mental health and other vulnerabilities (Ferguson, 2007). Engaging in meaningful social enterprise activities with other youth may provide an alternative to affiliation with deviant peers and engaging in unhealthful behaviors. Safe, high quality housing opportunities may provide a stable base from which to engage in pro-social activities and develop social ties more conducive to healthful behaviors.

Engaging homeless youth's involvement and interest is a key to success in any intervention to reduce substance use. Results of brief motivational interviewing interventions to engage homeless youth in substance abuse treatment services and to achieve reductions in substance use have been mixed (Baer et al., 2007; Peterson et al., 2006; Slesnick et al., 2009), suggesting that intervention approaches themselves must be sufficiently inherently attractive to overcome homeless youth's lack of motivation and trust in such services and must meet a diversity of youth's needs as they define them (Hudson et al., 2009; Nyamathi et al., 2007; Slesnick et al., 2009; Wenzel, D'Amico et al., 2009). Age of the youth must also be taken into account, where younger youth, or newly homeless youth, may benefit from attempts at family unification and older youth may benefit from independent and transitional living opportunities (Milburn et al., 2009; Slesnick et al., 2009).

Qualitative research with homeless youth emphasizes the relevance of comprehensive, innovative strategies such as social development to engage youth, alter social context, and change substance use behavior (Hudson et al., 2009; Nyamathi et al., 2007). Homeless youth have highlighted the importance of having drug treatment counselors who deeply understand their situations, strong and sustained mentorship from peers or other trusted individuals who understand their plight, and opportunities to engage in meaningful activities (e.g., employment, sports, arts) as alternatives to substance use. The perceived benefits of alternative activities must outweigh those of maintaining drug using peer networks and of using substances that they perceive to make their lives more tolerable or pleasurable.

The background characteristics of homeless youth in this study additionally contributed to their use of substances. Race and ethnicity were most notable for their consistency across substances. African American and Latino youth reported drinking significantly fewer drinks per day and smoking significantly fewer cigarettes than other youth, most of whom were White. This pattern is not unique to the homeless youth in this study. Other research has found that non-homeless Latino and particularly African American youth report less alcohol and cigarette use on average than White students (Wallace et al., 2002; Watt, 2008). A previous study of homeless youth in Los Angeles found that white ethnicity was a risk factor for alcohol use disorder (Unger et al., 1997).

Rates of past month substance use among the youth in this study (ranging from 66%–72%) are substantially higher than national rates based on samples of high school students (ranging from 20%–45%; (Centers for Disease Control and Prevention, 2008)). Average daily use of alcohol and cigarettes among homeless youth in our study was additionally greater than levels of use reported in an earlier study conducted in Los Angeles drop-ins, shelters, and streets (Milburn et al., 2005; Stein et al., 2009). Whereas youth in the present study reported a mean of 8.66 (SD = 0.60) cigarettes smoked daily and a mean of 2.62 (SD = 0.41) drinks consumed daily, youth in the earlier study reported a mean of 1.9 (SD = 1.6) cigarettes and 2.2 (SD = 2.1) drinks consumed daily. Newly homeless youth were oversampled in the survey by (Milburn et al., 2005), thus rates of substance use might be expected to be lower.

The notable rates of alcohol, cigarette, and marijuana use among the young people in this study present serious and potentially enduring health risks. A growing body of research involving non-homeless adolescents points to functional deficits due to marijuana use and alcohol use. The developing brains of adolescents may be particularly vulnerable to substances and thus to potentially long-term neurocognitive impacts (Bava et al., 2009; Jacobus et al., 2009). Substance use may furthermore be linked to mental health difficulties; a major cause for concern given the prevalence of mental health problems such as PTSD in this population (Gwadz et al., 2009). In a recent study of adolescents, smoking among girls was associated with mental distress measured three years later (Lien et al., 2009). Further investigation of tobacco's potential influence on mental health has been recommended (Mathers et al., 2006). Homeless youth face multiple structural barriers and co-morbidities in developing and achieving educational and vocational goals; functional impairments due to use of relatively accessible substances such as alcohol represent further impediments to these youth's chances at successful development and transition to adulthood.

Several study limitations should be noted. We achieved a representative probability sample of homeless youth in shelters, drop-ins, and street locations across a broad region of Los Angeles County, thus facilitating out ability to generalize results to the population of youth in these settings. To our knowledge, this was the first Los Angeles County-wide probability survey of substance use among homeless youth. Nonetheless, results may not be representative of homeless youth in other geographic areas. Another limitation is that the

substance use behavior of network members was not obtained directly; rather, youth reported on their perceptions of use by members of their network. Although studies have shown that youth self-report of their substance use is generally accurate (e.g., (Reinisch et al., 1991)), there may be a tendency for youth to overestimate the degree of correspondence between their own substance use and that of their peers. As previously discussed, we cannot determine the extent to which our results reflect network influence effects rather than selection effects, although there is both theoretical and empirical support for the idea that characteristics of personal networks have some influence on the substance use of homeless youth. Finally, although alcohol, tobacco and marijuana are the substances most commonly used by homeless youth, future research must also investigate the social context surrounding use of other drugs such as methamphetamine. Qualitative research with homeless youth in two Los Angeles County service settings suggests a growing prevalence of methamphetamine use (Nyamathi et al., 2007).

Findings from this study highlight the importance of social context in understanding alcohol, cigarette, and marijuana use among some of the most vulnerable youth in the nation. Study results also support the relevance of network-based interventions to change social context. As previously described, social development strategies coupled with safe, high quality housing may provide the stable base from which youth can develop social ties more conducive to healthful behaviors. Interventions might seek to enhance accessibility and strengthen youth's ties with adults in positions of responsibility, such as teachers and case managers. When substance abuse treatment is appropriate for homeless youth, interventions may need to be more resource-intensive and provide longer-term support for sustained social bonding and pro-social changes in the network. Additionally, efforts are necessary to prevent youth homelessness through, for example, early intervention with at-risk youth and their families, and support to enable youth in foster care to successfully transition to independent living.

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Table 1

Descriptive statistics (weighted): Homeless youth background characteristics, network characteristics, and substance use (N=419)

Variables	Percent	Mean	S.D.
Background characteristics			
Age (in years)		20.09	2.80
Gender (male)[1]	63.36		
Race/ethnicity			
African American	23.91		
Hispanic	20.00		
White	34.03		
Native American/Alaskan Native	1.59		
Native Hawaiian	1.73		
Asian/Pacific Islander	1.66		
Other or multiracial	17.08		
At least high school (GED)	46.59		
Sexual orientation	35.73		
Heterosexual	64.81		
Homosexual	11.04		
Bisexual	21.77		
Other	2.39		
Any time in jail or juvenile facility			
0 days	31.96		
1 – 30 days	31.28		
31 or more days	36.76		
Employment part- or full-time	14.30		
Never returned to home or guardian after leaving The first time	48.12		
Age first left home or guardian			
13 or younger	20.95		
14 – 15	22.33		
16 – 17	26.72		
18 or older	30.00		
Personal network characteristics			
Type of alters			
Number of alters who are:			
relatives		3.61	3.80
Sex partners		1.66	2.12
adults in positions of responsibility[2]		0.55	1.40
Others[3]		14.73	3.96
How (non-relative) alter was met[4]			
Number of alters who were met:		7.13	6.51

Variables	Percent	Mean	S.D.
in a shelter, drop-in center, or on the street[5]			
through treatment or self-help group (e.g., AA/NA)		0.05	0.36
in criminal justice system		0.10	0.56
through AOD use		0.25	2.16
Behavior of alters			
Number of alters who: drink heavily		8.79	7.92
Use drugs		9.99	8.02
attends school regularly		4.29	4.90
has a regular or steady job		6.39	5.40
Support from alters			
Number of alters			
respondent can count on to care about him/her		7.15	6.24
respondent can count on to lend money, provide food, etc.		6.00	6.77
Multiplexity			
Number of alters who:			
Drink, provide support		3.96	5.86
Drink, do not provide support		4.83	6.00
Do not drink, provide support		4.80	5.13
Neither drink nor provide support		6.41	6.61
Use drugs, provide support		4.19	5.82
Use drugs, do not provide support		5.80	6.53
Do not use drugs, provide support		4.57	5.15
Neither use drugs nor provide support		5.44	6.27
Network structure			
Density			
Overall density of network		0.16	0.21
Alcohol sub-group density		0.17	0.25
Drug sub-group density		0.16	0.24
Alcohol or Drug sub-group density		0.17	0.24
Outcomes			
Substance use, past 30 days			
Alcohol			
Any days of alcohol use	67.56		
Average number of drinks consumed per day		2.61	8.27
Cigarette smoking			
Any days of cigarette smoking	72.00		
Average number of cigarettes smoked per day		8.64	12.17
Marijuana			
Any times marijuana use	66.40		
Number of times used marijuana		57.50	140.84

[1] Male gender refers to males who also reported having a penis.

[2] For each of two respondents, one alter identified as an adult in a position of responsibility was additionally identified as a sex partner. These two alters were re-classified as sex partners to ensure mutually exclusive categories for this variable.

[3] "Others" were neither relatives, sex partners, or adults in positions of authority. These "other" individuals included, for example, co-workers and other shelter residents.

[4] List is not exhaustive thus numbers do not add up to 20.

[5] Alters met in shelters, drop-ins and street do not include service providers in those settings.

Table 2

Results of multivariate linear regressions predicting average number of drinks per day and average number of cigarettes per day past 30 days, and negative binomial regression predicting number of times used marijuana past 30 days (weighted analyses). N = 419

	Substance use past 30 days		
	Average number cigarettes per day	**Average number drinks per day**	**Times used marijuana**
	Coeff[1] (SE)	**Coeff (SE)**	**Coeff (SE)**
Predictor Variables			
Background characteristics			
Age	−0.496 (0.232) *	−0.164 (0.155)	0.011 (0.051)
Black (vs. other)	−4.297 (1.158) **	−2.124 (0.722) **	−0.062 (0.252)
Hispanic (vs. other)	−3.682 (1.224) **	−2.032 (0.711) **	0.004 (0.289)
Gender (male)	1.661 (0.964)	0.578 (0.725)	0.211 (0.273)
Gay, lesbian, bisexual[2]	0.300 (1.118)	−1.843 (0.619) **	0.172 (0.251)
Education (at least H.S. or GED)	−0.747 (1.091)	0.045 (0.804)	0.088 (0.213)
Employed half-, full-time	1.993 (1.619)	−0.636 (0.549)	0.217 (0.308)
Jail/detention lifetime[3]	1.629 (0.646) *	−0.030 (0.441)	0.035 (0.162)
Never returned home after leaving the first time	−1.444 (1.084)	−0.256 (0.728)	0.319 (0.204)
Age when first left home[4]	0.526 (0.535)	−0.205 (0.404)	−0.309 (0.099) *
Personal network characteristics			
Types of alters (number):			
Relatives	0.099 (0.156)	0.102 (0.103)	0.035 (0.038)
Sex partners	0.189 (0.283)	0.216 (0.208)	0.087 (0.068)
Adults in positions of responsibility	−0.572 (0.306)	−0.305 (0.148) *	−0.083 (0.110)
How non-relative alters were met (number):			
Shelter, drop-in center, or on the street	0.139 (0.121)	0.007 (0.087)	0.043 (0.020) *
Through drug or alcohol use	0.500 (0.314)	0.788 (0.170) **	0.040 (0.051)
Through treatment or self-help group (e.g. AA/NA)	0.956 (1.121)	−0.641 (0.411)	−0.572 (0.287) *
Behavior of alters (number):			
Drinks heavily or uses drugs[5]	0.395 (0.092) **	0.118 (0.060) *	0.143 (0.018) **
Attends school regularly	−0.505 (0.107) **	−0.133 (0.061) *	−0.013 (0.027)
Has a regular or steady job	−0.012 (0.115)	−0.117 (0.079)	−0.020 (0.023)
Structure:			
Alcohol or drug sub-group density[6]	0.164 (2.438)	3.193 (2.320)	0.994 (0.614)

[1] Unstandardized regression coefficients are reported.

[2] A dichotomous variable was used because none of the defined sexual orientations (i.e. gay/lesbian or bisexual) differed in comparison to heterosexual orientation when examined in association with substance use

[3] Jail/detention lifetime is an ordinal variable as shown in Table 1

[4] Age first left home is an ordinal variable as shown in Table 1

[5] Due to the high level of association between the number of alters using alcohol and the number of alters using drugs, we derived and used one variable in each regression to reflect the number of alters using either alcohol or drugs.

[6] Due to the high level of association between the density of the alcohol using subgroup and the density of the drug using subgroup, we derived and used one variable in each regression to reflect the subgroup density of alters using either alcohol or drugs. Results depicted for alcohol or drug subgroup density were derived from separate regression models in which density replaced the number of alters using alcohol or drugs, as explained in the Methods.

* $p < .05$;

** $p < .01$

Table 3

Results of multivariate regressions to test multiplexity. Multiple linear regressions predicting average number of drinks per day and average number of cigarettes per day past 30 days, and negative binomial regression predicting number of times used marijuana past 30 days (weighted analyses). N = 419

	Substance use past 30 days		
	Average number cigarettes per day	**Average number drinks per day**	**Times used marijuana**
	Coeff [1] (SE)	**Coeff (SE)**	**Coeff (SE)**
Multiplexity[2]			
Number of:			
Substance using alters [3] who provide support	0.330 (0.143) *	0.185 (0.095)	0.145 (0.025) **
Substance using alters who do *not* provide support	0.449 (0.109) **	0.051 (0.071)	0.135 (0.019) **
Non-substance using alters who provide support	−0.028 (0.261)	0.121 (0.213)	0.068 (0.038)

[1] Unstandardized regression coefficients are reported.

[2] Results for multiplexity were derived from regression models in which the main effects (i.e. number of substance using alters and number of alters providing support) were omitted, as explained in the Methods. Coefficients for variables representing background characteristics and other personal network characteristics (not presented) did not differ from the results presented in Table 2 in either magnitude or significance level.

[3] Non-substance using alters who did not provide support are omitted from the equations (i.e., the omitted category).

* $p < .05$;

** $p < .01$