Published in final edited form as:
Am Behav Sci. 2005 April 1; 48(8): 1102–1123. doi:10.1177/0002764204274194.

The Effects of Peer Group Network Properties on Drug Use Among Homeless Youth

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Abstract

The authors examine how the properties of peer networks affect amphetamine, cocaine, and injection drug use over 3 months among newly homeless adolescents, aged 12 to 20 in Los Angeles (n = 217; 83% retention at 3 months) and Melbourne (n = 119; 72% retention at 3 months). Several hypotheses regarding the effects of social network properties on the peer influence process are developed. Multivariate logistic regression analyses show that higher concentrations of homeless peers in networks at recruitment were associated with increased likelihood of amphetamine and cocaine use at 3-month follow-up. Higher concentrations of injecting peers were associated with increased risk of injection drug use 3 months later. Change in network structure over time toward increased concentrations of homeless peers was associated with increased risk of cocaine use and injecting. Higher density networks at baseline were positively associated with increased likelihood of cocaine and amphetamine use at 3 months.

Keywords

peer influence; networks; drug use

Drug-using homeless youth are a uniquely troubled subpopulation of homeless persons. Homeless youth are socially excluded, dislocated, and harassed because of the following three confounding stigmas: being homeless, an adolescent, and a drug user. These youth are pushed out of public spaces, suffer harassment from police, and face the daily struggles of survival without the resources of stable housing, all while coping with the normal difficulties of transitioning from childhood to adulthood. But life on the streets makes the adolescent issues regarding lacking education, job skills, and adult legal rights and status all the more difficult. As drug users, these youth face not only the physical and psychological problems of addiction

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but also the social stigmas associated with drug use and the hassles from police, drug dealers, and gangs that can result from drug use on the street. For drug-using homeless adolescents, peer networks become a refuge from the exclusion they suffer from the broader society. These networks however can introduce, reinforce, and normalize the very behaviors that are the source of their exclusion.

Homeless youth are more likely to engage in drug and alcohol use and have more favorable attitudes toward drugs and alcohol as compared to their non-homeless peers (Fors & Rojek, 1991; Greene, Ennett, & Ringwalt, 1997; Kipke, Montgomery, & MacKenzie, 1993; Teesson, Hodder, & Buhrich, 2003). In nationally representative samples, rates of cocaine use among homeless adolescents were 4 to 5 times that of nonhomeless adolescents, amphetamine use was 3 to 4 times more prevalent, and use of marijuana was 2 to 3 times higher (Greene et al., 1997). Moreover, homeless youth are often documented with having "drug abuse" disorders (e.g., 71% in Hollywood, California; Kipke, Montgomery, Simon, & Iverson, 1997).

Peers play an important role in drug use among homeless adolescents (McMorris, Tyler, Whitbeck, & Hoyt, 2002; Whitbeck & Hoyt, 1999), just as they do for nonhomeless adolescents (Andrews, Tildesley, Hops, &Li, 2002). In general, affiliations with deviant peers influence alcohol use, drug use, and nicotine use (Fergusson, Swain-Campbell, & Horwood, 2002), and association with prosocial peers is predictive of abstinence from alcohol use (Spoth, Redmond, Hockaday, & Yoo, 1996).[1] As perceptions of peer norms regarding alcohol use are increasingly positive, the likelihood of alcohol use among adolescents increases (Kuther & Higgins-D'Alessandro, 2003). Moreover, outcomes of drug treatment programs are influenced by people's social networks; relapse is more likely when drug use is common among members of one's social network, whereas involvement in sober networks buttresses treatment (e.g., Gogineni, Stein, & Friedman, 2001; Havassy, Wasserman, & Hall, 1995; Tuten & Jones, 2003). The goal of this article is to examine how properties of social networks influence substance use over time among newly homeless adolescents. Three hypotheses are examined regarding the density and concentration of risk behaviors in the social networks of newly homeless youth in Los Angeles, United States, and Melbourne, Australia.

THEORETICAL MODEL

Homeless adolescents' involvement with peer networks is more exaggerated and less stable than that of nonhomeless adolescents. In general, adolescence is a time of shifting social networks, away from family-centered networks toward peer-centered networks and romantic partners (Furman & Buhrmester, 1992). Adolescents spend more time with peers than family, enjoy the time spent with peers more, and are more likely to engage in intimate self-disclosure with peers (Collins, 1988; Larsen & Prescott, 1977).

According to Whitbeck and Hoyt (1999), many homeless adolescents come from dysfunctional/abusive families that set them on a negative developmental trajectory. Becoming homeless further embeds youth in deviant peer networks and further disengages youth from their family networks. Over time, many of these youth are drifting further away from parental influences and increasing involvement with institutional authority. As their time on the streets increases, the opportunity for homeless youth to form ties with deviant peers increases (Whitbeck & Hoyt, 1999). Moreover, homeless youth tend to form ties with other street youth who are engaged in similar deviant behaviors (Kipke et al., 1997). Problem behaviors are reinforced by their associations with deviant peers on the streets (Hagen & McCarthy, 1997;

[1]Obviously, not all homeless youth are "deviant," and neither are all deviant youth homeless. We do not consider homelessness unto itself as deviance. What is at issue in this article is how association with peers who engage in deviant behaviors (e.g., drug use) affects young people's pathways toward deviant behaviors. This issue is particularly salient among homeless youth because of the disproportionate involvement in deviant behaviors among homeless youth as well as the central role of peers to the life of homeless youth.

Whitbeck & Hoyt, 1999). Exposure to risky behavior in one's network has negative effects on the behaviors of homeless youth. Recent work has found that as the number of friends who sell sex in a network increases, engagement in risky sexual behaviors likewise increases (Tyler, Whitbeck, Hoyt, & Yoder, 2000).

Much of the discussion of peer influence processes focuses on issues of self-selection versus social learning effects (e.g., Bandura, 2001; Dishion & Owen, 2002; Fergusson et al., 2002; Sutherland & Shepherd, 2002). Adolescents' peer influence may be the result of a cause-and-effect relationship in which exposure to deviant behaviors, such as drug use, promotes drug-using behavior among adolescents (i.e., the social learning effect; Bandura, 2001; Dishion & Owen, 2002; Deater-Deckard, 2001). Alternatively, peer influence may primarily be the artifact of peer group formation based on homophillous associations. Young people seek out other young people who legitimize and reinforce their preferred behaviors, be they deviant or prosocial (Fergusson et al., 2002; Kandel, Davies, & Baydar, 1990). Although we acknowledge the conceptual importance of these two mechanisms, in practice both often conspire to produce the effects observed as peer influence. Regardless of self-selection or social learning, it is clear that peers substantially influence one another's behaviors (Booth, Zhang, & Kwiatkowski, 1999; Catania, Kegeles, & Coates, 1990; Fergusson et al., 2002; Jessor, Van Den Bos, Vanderryn, Costa, & Turbin, 1995; Prinstein, Boergers, & Spirito, 2001; Sutherland & Shepherd, 2002).

The peer influence process may be thought of as consisting of two distinct steps. First, for young people to acquire a new drug-taking behavior, they first must be exposed to that behavior (Bandura, 1986). Adoption, the second step, is more complex. Several factors may affect this step, including the status, power, and prestige of particular peers within the network who are modeling the new behavior; the ease of trying the new behavior; the costs of trying and/or discontinuing the new behavior; the social acceptability of the new behavior; or the legitimacy of that behavior in the network as well as the wider society (Bandura, 1986). The concentration of peers who are participating in a behavior in the network as well as the structure of network linkages between peers affect both stages of this process.

The first network property we examine is concentration of a behavior within a network. Within the context of this network analysis, *concentration* refers to the proportion of peers engaged in a particular behavior given the shape of a young person's particular social network.

> *Hypothesis 1:* Youth in networks with a greater concentration of peers engaged in a drug-using behavior are more likely to participate in that behavior compared to youth in similarly shaped networks with a lower concentration of drug-using peers.

Figure 1 graphically displays this hypothesis. This hypothesis is based on how behavioral concentration affects both aspects of the peer influence process. First, in networks where more peers engage in a particular behavior, a given young person is more exposed to that behavior. Second, in networks with more peers engaging in a drug-using behavior, that behavior is more "normal." The greater social acceptability and legitimacy of the behavior as well as the greater ease of access to those drugs and/or drug-using paraphernalia increase the likelihood that a given young person will adopt that behavior. Alternatively, self-selection processes may underlie such cross-network comparisons such that young people locate themselves in networks of like-minded and like-acting peers.

> *Hypothesis 2:* Over time, as the concentration of peers engaging in a drug-using behavior increases in a given social network, the likelihood that a young person engages in that behavior increases.

The rationale for this hypothesis is the same as that for Hypothesis 1. The difference between the two however is that Hypothesis 1 compares two networks at one point in time, whereas

Hypothesis 2 compares one network at two different points in time. Thus, as a network changes to include more peers engaging in a drug-using behavior, a given youth is increasingly exposed to the behavior, and the behavior becomes normative. It gains social acceptability, and the ease with which the young person can try to adopt the behavior for himself or herself increases. Hypothesis 2 may however be simply motivated by self-selection pressures, in which case youth seek to actively change their network affiliations to include peers who engage in activities similar to their own. Regardless of motivation however, the hypothesis remains unchanged.

Social scientists have long contended that networks with higher densities, specifically, greater interconnectivity between the group members (see Wasserman & Faust, 1995, chapter 4 for a formal definition), are more homogenous in terms of the behavior of the members of the network (e.g., Blau, 1964; Durkheim, 1893/1964). If this is true, then density does not have a straightforward effect on drug-using behaviors. As the density of a network increases, information and resources flow more easily because any one individual has fewer ties to bridge to reach another individual who is already in possession of that information or resource. Accompanying this greater social solidarity is a greater reinforcement of norms, and hence norms are less malleable. On the other hand, beneficial new behaviors and ideas can spread more rapidly throughout the network because of the greater interconnectivity of its members. As far as drug-using behaviors are concerned, one would expect an interaction between the concentration of peers engaged in a behavior and the density of the network.

> *Hypothesis 3:* Density interacts with concentration of drug-using behaviors such that at low concentrations the effect of density will be to decrease the likelihood of drug-using behavior, whereas as concentration increases, the effect of density will be to increase the likelihood of drug-using behavior.

As with the other two hypotheses, a self-selection pressure may just as easily motivate such associations, homophillous youth may form more densely interconnected networks of affiliation based on their self-perceived similarities. This possibility however does not change the nature of predicted relationships.

METHOD

SAMPLE

Homeless adolescents were recruited in Los Angeles County, California, in the United States and Melbourne, Australia. The two following criteria were used to select participants: (a) age ranging from 12 to 20 years[2] and (b) spent at least two consecutive nights away from home without parent's or guardian's permission if younger than age 17 years or been told to leave home.[3] The two following subgroups of homeless youth were identified: (a) *newly* homeless youth who had been living away from home for less than 6 months and (b) *experienced* homeless youth who had been living away from home for more than 6 months.[4] This article uses the subsample of newly homeless youth, who were followed longitudinally. Retention rates for 3 months were 83.8% in the United States and 71.7% in Australia.

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[2]In the United States, many 18- to 20-year-olds still live at home despite their attainment of the legal age of majority; youth of this age are still dependent on their parents and are part of "emerging adulthood" (Arnett, 2000). We do not include in our sample those youth older than the age of 18 who are living in stable independent housing outside of their parents' homes.

[3]Age of majority in Australia is 18 years of age, as it is in most states in the United States (Australia Department of Justice, 1981).

[4]There is a great deal of variability in the population of homeless youth (e.g., Ringwalt, Greene, Robertson, & McPheeters, 1998). Moreover, many obstacles face researchers attempting to fully enumerate and gather longitudinal data on nontraditional populations such as homeless youth (Wright, Allen, & Devine, 1995). Our definition of *newly* homeless youth and the age range under investigation evolved from an audit of homeless youth throughout Los Angeles County (Witkin, Milburn, May, Brooks, & Rotheram-Borus, 2004) and from information gathered from interviews with service providers who work in the field with homeless youth (Brooks, Milburn, Witkin, & Rotheram-Borus, in press).

The recruitment process varied somewhat across the two countries. The variation reflected our attempts to be respectful of the research norms and expectations of service providers in the respective countries. In the United States, these sites were selected through a systematic process. First, all of the potential recruitment sites for homeless adolescents in Los Angeles County were identified by interviewing line and supervisory staff in agencies that served homeless adolescents throughout Los Angeles County (Brooks, Milburn, Witkin, & Rotheram-Borus, in press). As a result, 30 sites were identified, including 17 shelters and drop-in centers and 13 street hangout sites. Next, the 30 sites were audited at preselected times and days per week during three different weeklong time periods to determine the numbers of homeless adolescents that could be found at each site (Witkin, Milburn, May, Brooks, & Rotheram-Borus, 2004). All of these sites were included as recruitment sites. Interviewers were sent out in pairs to predetermined sites, including shelters, drop-in centers, and street hangout sites that covered the entire geographic region of Los Angeles County, to screen and recruit eligible homeless adolescents.

In Australia, recruitment sites were systematically selected from a database of all youth and homeless services across the five metropolitan regions of Melbourne. Service managers were approached to seek permission for their service's involvement in the project. Of the 114 eligible services, 112 agreed to participate. Participants were subsequently recruited from 95 youth or homeless services. Each service was given an information session that outlined the project and informed staff of the eligibility criteria for participants. Potentially eligible homeless young people were referred to the study by staff working at these services, either by giving the young person the project's free-call number or telephoning the number on their behalf. The majority of the surveys were conducted at the referral service; however, some surveys were undertaken at the research center.

Interviewers at both sites conducted comprehensive screening of adolescents with a 13-item screening instrument to determine whether they were eligible to participate in the study. The instrument was designed to mask the eligibility criteria, confirm eligibility, and establish the length of time the young person had been away from home. In the United States, all newly homeless adolescents who were eligible and agreed to participate were included in the sample, resulting in a census for newly homeless adolescents. The refusal rate for newly homeless adolescents was 9.3%. Results from overall chi-square tests examining race/ ethnicity, gender, and age show newly homeless adolescents who refused to participate tended to be European American and older. In the United States, experienced homeless adolescents were selected via a quota system wherein the first 9 male and 9 female experienced homeless adolescents who were eligible and agreed to participate were included in the sample. The refusal rate for experienced homeless adolescents was 5.1%. Experienced homeless adolescents who refused to participate did not differ significantly in race/ethnicity, gender, or age from experienced homeless participants. In Australia, all newly and experienced homeless adolescents who were eligible and agreed to participate were included in the sample.

Participants were assured of confidentiality, and the informed consent process was reviewed. Participants were also told that interviewers were required to report current physical or sexual abuse (if younger than 17 years) and serious suicidal or homicidal feelings.

PROCEDURE

The interviewers received approximately 40 hours of training, which included lectures, role playing, mock surveys, ethics training, emergency procedures, and technical training. All interviews were conducted face to face by trained interviewers using an audiotaped computer-assisted interview schedule (audio-CASI) and lasted between 1 and 1½ hours. Paper-and-pencil surveys were used at a few street sites out of necessity. Participants received $20 in local

currency as compensation for their time for the baseline interview and $25 for the 3-month follow-up.

MEASURES

Background characteristics—Age was scored on a continuum of years. Gender was a dummy variable, coded 1 for male respondents, 0 for female. Site was likewise a dummy variable, coded 1 for American respondents, 0 for Australians.

Baseline behavior—Amphetamine user was dummy coded 1 for those adolescents who "used stimulants or amphetamines, not cocaine, in the past 3 months, 90 days" at least once at the time of the baseline interview. Likewise, cocaine user was dummy coded 1 for those adolescents who "used crack or cocaine in the past 3 months, 90 days" at least once. Injection drug user was dummy coded 1 for those adolescents who injected any controlled substance (e.g., stimulants, cocaine, opiates) in the 90 days prior to being interviewed. Drug use behaviors at 3 months were calculated in the exact manner as baseline variables using the data collected at the 3-month follow-up interview.

General network properties—The concentration of injecting friends variable was constructed from responses to the following single item, asking young people to characterize the makeup of their friends and acquaintances:[5] "How many of your friends: inject drugs?" The item is scored on a 4-point Likert-type scale whose responses range from *none*, *some*, *most*, to *all*. The change in composition variable was constructed by taking the response to the concentration of injecting friends item given at the 3-month follow-up interview and subtracting the value of the response given at the baseline interview. The resulting variable ranges from –3 to 3. A score of 3 meant that there was a three-category increase in the number of friends who were injectors (i.e., at baseline they had responded *none*, and at 3 months they responded *all*). The concentration of homeless friends variable and the corresponding change in concentration score were calculated in the same manner using a question that asked respondents, "How many of your friends: are homeless?"

Density was the average response to four items, each of which was ranked on a 4-point Likert-type scale, ranging from *strongly agree*, *agree*, *disagree*, to *strongly disagree*. The four items asked young people to assess if their friends and acquaintances "tend to know each other," "get along with each other," "do things together," and "tend to be very separate from each other and not form groups." The four items were rescaled such that an increasing density score reflects networks that are more cohesive; the four items have a Cronbach's alpha value of 0.74.

Both the density and concentration measures presented here are self-evaluations of network properties. These are not true structural measures of these properties. Although egocentric network data that explicitly delineate the structure of each youth's social network would be the ideal data for this analysis, such data are not currently available for this sample. The categories of *none*, *some*, *most*, and *all* could be seen as vague quantifiers for they do not allow for a standardization across respondents. These categories however do allow for variation in self-report. Self-reported measures such as these are a standard part of survey methodology in social science research (Babbie, 2004). More important, we believe that the measures used adhere to the basic network concepts we are attempting to test despite the fact that they suffer some of the problems of self-assessment. Moreover, the influence model tested with these variables addresses the adopting of external behaviors based on exposure to behaviors. As such,

[5]At baseline, youth were asked to evaluate separately the behaviors of their "friends" and their "acquaintances." For the baseline measures, the mean of the responses to questions regarding friends and acquaintances was used. Correlations between the responses to friends and acquaintances were extremely high. Subsequent assessments (including the 3-month assessment used here) asked youth only to assess the behavior of their friends.

the perceptions that youth have of their social networks are highly relevant to this process of adoption. If all of the friends a youth knows are engaged in a given behavior and that youth knows nothing of such actions, presumably the influence process will not be at work. Although these subjective measures of network properties could be inadequate for other models, the self-perceptions of what transpires in a youth's network is very relevant to the influence model tested here.

DATA ANALYSIS

Drug use behaviors and background characteristics of the homeless young people were reported, and differences based on country were statistically assessed. Chi-square tests were employed to assess proportional differences for categorical variables. For continuous variables, a *t* test was performed to assess the significance of differences across the two countries. Any *p* value less than .05 was considered significant.

To test the hypotheses presented earlier concerning the effects of social network properties on homeless young people's drug use behaviors at 3 months, two models were analyzed for each of the three dependent variables, amphetamine use, cocaine use, and injection drug use.[6] Model 1 tests Hypothesis 1 and Hypothesis 3. Both of these hypotheses address drug use at 3 months as a function of baseline network properties. Model 2 tests Hypothesis 2, which addresses drug use at 3 months as a function of changes in network properties over time. Hypothesis 2 is tested separately to avoid issues of multicollinearity. The change in concentration variables are constructed from the difference between network properties at 3 months and baseline. Because the network change variables are constructed partly from the baseline network properties, there is a high correlation between the two sets of variables, leading to model instability when entered simultaneously into a multivariate model. Covariates used in all analyses include gender, age, site, and the baseline drug use. Concentration of injecting friends serves as one proxy measure for exposure to drug use in all three sets of analyses because it is the only available measure that assesses direct exposure to drug use. To overcome some of this limitation, concentration of homeless friends is also included in each set of analyses as an additional measure of exposure to "deviant" behaviors, which very often includes drug use among homeless adolescents (Fors & Rojek, 1991;Greene et al., 1997;Kipke et al., 1993; Rosenthal, Moore, & Buzwell, 1994; Teesson et al., 2003). Obviously however, adolescents are exposed to behaviors other than drug use when they are in contact with homeless peers.

RESULTS

Table 1 provides a summary of drug use activity among the newly homeless young people who were followed at 3 months. In the United States, both amphetamine use and cocaine use are quite high at baseline (27% and 20%, respectively) and were reduced somewhat at the 3-month follow-up (12% and 16%, respectively). In Australia however, cocaine use remained stable at 9%, and amphetamine use increased from 15% at baseline to 29% at the 3-month follow-up. Injection drug use increased slightly in each country. In both countries, 5 respondents reported injecting at baseline, and 8 reported injecting at the 3-month follow-up interview. The distribution of drugs injected varied across site. In the United States, 38% of injectors injected amphetamines, 25% injected cocaine, and 50% injected heroin. In Australia however, 88% of injectors injected amphetamines, 25% injected cocaine, and 38% injected heroin. Although the absolute number of injectors in each country is small, those youth who inject tend to inject

[6]Australian and American respondents are analyzed simultaneously in one model, which fits a main effect for country. Additional analyses revealed no country by independent variable interaction effect was ever statistically significant for any of the three dependent variables when each interaction was entered into the model one at a time. We are thus confident, despite some differences in subject recruitment strategy, that combining the samples for a single analysis is an acceptable modeling strategy.

multiple drugs. Moreover, most youth who injected at 3 months were new injectors; in the United States, 75% of injectors did not report injecting at baseline, and 63% of Australian injectors did not report injecting at baseline.

Table 2 provides descriptive statistics for the variables used in the multi-variate logistic regression models. It summarizes between-country differences in the variables to be used in the analysis. Australian youth were slightly older on average. The distribution of gender in the two samples did not significantly differ. More American youth claimed to be either a cocaine user or an amphetamine user at baseline compared to their Australian peers, although injection drug use at baseline was not significantly different. With respect to network properties, the two countries are very similar. The one variable for which there is a significant difference between the two countries is in change in concentration of homeless friends. In both countries, the average change score is negative, indicating a move away from associations with other homeless youth. This trend however is significantly more pronounced in the United States as compared to Australia.[7]

Amphetamine use

Table 3 presents the results of the multivariate logistic regression models for amphetamine use. Not surprisingly, amphetamine use at baseline is a powerful predictor of amphetamine use 3 months later (odds ratio [OR] = 9.9 in Model1;OR = 13.7 in Model 2). As suggested by the distributions in Table 2, American homeless youth were less likely to use amphetamines at 3 months compared to their homeless Australian peers. Far more interesting however is the powerful effects social network properties have on amphetamine use at the 3-month follow-up. As predicted by Hypothesis 1, there is a strong positive effect of the concentration of homeless friends on amphetamine use; a 1-point difference in the concentration of homeless friends is associated with a 2.1 times increase in the likelihood of using amphetamines. Youth embedded in networks at baseline with higher concentrations of homeless youth are more likely to be amphetamine users at 3 months. Model 2 tests the second hypothesis regarding changes in network structure over time. No support for this second hypothesis is found in Model 2. Turning to the third hypothesis, Model 1 reports that as the density of the network increases, the likelihood of amphetamine use increases (OR = 1.9). The density by concentration interaction effect predicted by Hypothesis 3 however does not find support in Model 1. The interaction effect failed to attain standard ($p < .05$) levels of statistical significance and was dropped from the model.

Cocaine use

Cocaine use followed a similar pattern to that of amphetamine use (Table 4). Cocaine use at baseline is a positive predictor of cocaine use 3 months later; youth who used at baseline are approximately 2.5 times more likely to use at 3 months as compared to nonusers at baseline (OR = 11.0 for Model 1; OR = 12.2 for Model 2). Model 1 supports Hypothesis 1; a one-category increase in the concentration of homeless friends at baseline is associated with a 1.8 times increase in the likelihood of using 3 months later. Youth who are embedded in networks with higher concentrations of homeless peers at baseline are more likely to use cocaine 3 months later as compared to youth who are embedded in networks with lower concentrations

[7]An analysis of attrition revealed that three of the measures used in this study had significant bivariate associations with attrition: Australians were more likely to be lost to follow-up, injection drug users at baseline were more likely to be lost to follow-up, and as the concentration of homeless friends increases, the likelihood of being lost to follow-up increases. When these variables were entered simultaneously in a multivariate model, none attained standard levels of statistical significance. In general, we are confident that these attrition findings do not invalidate our results and the conclusions we draw from those results. This differential loss to follow-up actually introduces a potential bias that acts against our proposed hypotheses. Because risk-taking youth and youth embedded in risk-taking networks are among those most likely to be lost to follow-up, finding confirmation of our hypotheses may be more difficult in the face of this differential loss to follow-up.

of homeless peers. Support for Hypothesis 2 is found in the results of Model 2. Over time, as networks change to include more homeless peers, youth are more likely to engage in cocaine use. A one-category shift in concentration over time is associated with a 2.1 times increase in the likelihood of using cocaine at 3 months. Hypothesis 3 finds the same attenuated support here in the cocaine use models. Youth in higher density networks are more likely to use cocaine at the 3-month follow-up. There is however no significant interaction with either the concentration of injecting peers or homeless peers, as predicted by Hypothesis 3.

Injection drug use

Injection drug use also provides additional support for the hypotheses guiding this analysis (Table 5). As with the other two analyses, injecting behavior at baseline is a significant predictor of injecting behavior 3 months later (OR = 14.0 in Model 1; OR = 14.7 in Model 2). Hypothesis 1 finds support in Model 1. Youth embedded in networks with more injecting peers at baseline are more likely to themselves inject 3 months later (OR = 2.6). Hypothesis 2 likewise finds support in Model 2 for injecting behavior. As the concentration of homeless friends increases over time to include more homeless friends, the likelihood of injecting at 3 months increases (OR = 2.0). Hypothesis 3 finds no support in Model 1. First, there is no significant main effect for density. Second, in a separate analysis, the interaction between density and the concentration of injecting peers was added and failed to attain standard levels of significance. Finally, in an additional analysis, the interaction between density and concentration of homeless peers was added. This interaction was significant but caused the model to become highly unstable and was therefore dropped from the analysis.

DISCUSSION

It is well established that peers have a profound impact on the drug-taking behavior of adolescents (Andrews et al., 2002; McMorris et al., 2002; Whitbeck & Hoyt, 1999). How the properties of social networks facilitate the process of peer influence however has to this point been underdeveloped. Using data collected from a longitudinal study of newly homeless youth in Los Angeles, United States, and Melbourne, Australia, we examined three hypotheses concerning the effect of network properties on drug-using behavior. We looked at how concentration of drug-using peers affected drug use across different networks at a single point in time, how changes in the concentration of drug-using peers within a network over time affected drug use, and how network density interacts with concentration of drug-using peers to affect drug use. Support for the first two hypotheses was found in the data relating to amphetamine use, cocaine use, and injection drug use at the 3-month follow-up assessment.

For newly homeless adolescents, the context of their social networks with respect to the behaviors of peers in the network affects their behavior. Specifically, we found that cross-network differences in concentration of drug-using peers affected cocaine use, amphetamine use, and injection drug use. The concentration of injecting peers at baseline had a positive effect on amphetamine use, cocaine use, and injecting at 3 months. Moreover, the concentration of homeless peers in the network at baseline had a positive effect on amphetamine use and injecting at 3 months. Differences across networks in the concentration of drug-using peers affected the level of exposure young people have to drug-using behavior. Given these results, one may conjecture that in networks with higher concentrations of drug-using peers, young people saw more drug-using behavior, drug-using behavior was more normative and more legitimate, access to drugs and drug-using paraphernalia was easier, and the socioeconomic costs of engaging in drug use were lower. Each of these factors is likely to contribute to pulling adolescents in networks with high drug-using concentrations into drug-using behaviors.

Given the present analysis however, it is impossible to determine whether changes in network properties over time were the cause of drug use at 3 months or the effect of this drug use. It is

possible that young people were the passive recipients of network change. Social networks changed around them, new peers came on the scene, and old peers disappeared. Alternatively, a network could have stable membership, but the behaviors of the youth in that network changed. In either case, a young person's exposure to drug use was something that happened to him or her. It is possible however that young people were actively changing their peer group affiliations based on their drug-using preferences. Drug-using young people may have sought out other drug-using friends who legitimize their drug use and facilitate continued use. Conversely, young people who were not users may have sought out other nonusing peers or limit their affiliations with peers whose drug use made them uncomfortable. Presumably, some combination of these processes was in play in our analysis, with some young people falling into each of these possible patterns of affiliation.

The hypothesis concerning network density found the most tentative support in the present analyses. There was a significant main effect for density in both the amphetamine and cocaine use models. The predicted interaction between density and concentration of drug-using peers never emerged. As youth perceive their friends to be more highly interconnected, their likelihood of drug use 3 months later increases for cocaine and amphetamine use but not injecting. Access to drugs appears to be greater in denser networks. This seems sensible given that denser networks facilitate the flow of information and resources. But why there is no significant interaction with the concentration of deviant peers remains elusive.

It is possible that homeless youth are using drug taking in an instrumental way. Youth who are not regular drug users may participate in drug use as a way of gaining access to the social network of other homeless youth. Using drugs proves that they are "down" and helps them to be "in." Once access to a network is achieved however, drug use may not necessarily continue. So dense networks may facilitate exposure to drug use, but once youth become integrated into such networks, drug use need not be an integral part of social interactions within the network of homeless youth. What these results reveal, if nothing else, is the complexity of density as a social network variable within the context of adolescent homelessness.

There are some limitations of the present analysis. First, the measures used for this analysis are subjective. The network variables used here rely on the youth's subjective self-evaluation of their social networks. These subjective measures do not provide us the ability to objectively assess the structures of the homeless youth's social network. These self-assessments however are the best measures of network properties currently available for this sample. There is a need for rigorously collected egocentric network data on these concepts, and such data are currently being collected by the authors. Second, we relied on two proxy measures for the concentration of drug-using behaviors in the social networks. Injection drug use is an ideal measure for injecting behavior but only suggestive of the content of drug use of other sorts. Likewise, although homeless youth are well known to be more involved in drug use than nonhomeless youth (Fors & Rojek, 1991; Greene et al., 1997; Kipke et al., 1993; Rosenthal, Moore, & Buzwell, 1994; Teesson et al., 2003), more than drug use is being tapped by the concentration of homeless peers. Despite these limitations however, significant positive effects for both proxy variables were found for all three outcomes.

These data point to the importance of social networks as a relevant focus for drug abuse interventions. Adolescents in general are susceptible to the influence of their peer networks. Homeless adolescents, with their age-segregated networks disproportionately made up of other homeless youth, may be even more vulnerable to the risky influences embedded within their networks. Effective interventions must be developed with these structural realities and processes of transmission in mind. Interventions that are designed with individual youth as their focus cannot easily mediate these competing influences. Interventions that target multiple members of a network or that attempt to utilize existing network structures are likely to find

new avenues for successful behavior change where individual targeting interventions have not yet ventured.

It is important to consider the social context of these youth. Skills that make surviving life on the streets possible may be in other contexts viewed as antisocial or deviant (Tyler & Whitbeck, 2004). Many homeless youth rely heavily on other homeless youth who themselves are involved in a variety of risky behaviors. It is difficult to change the behaviors of an individual if his or her network remains filled with opportunities for risk taking. We advocate changing networks, not just individuals. In much the same way that Alcoholics Anonymous relies on connecting recovering addicts to new networks of other recovering addicts who can support one another, we advocate interventions at a street level that attempt to connect homeless youth with positive social influences. We recognize that if you cannot change the behaviors of the peers with whom homeless youth associate, changing their behaviors will be very difficult.

We believe that the social networks of homeless youth can be used in a positive way. Many of these youth are extremely resilient (Tyler & Whitbeck, 2004). More than just deviance is practiced in these networks. Homeless youth are also engaged in a great deal of mutual social support and exchange of necessary resources for surviving on the streets. Even the nontraditional social networks of homeless youth confer benefits to their members (Tyler & Whitbeck, 2004). Utilizing the existing network structures and the flow of positive information and skills through them may provide researchers with new avenues through which they can more effectively target homeless youth for interventions. Much as Kelly (1995) was able to access social influence leaders within the community to effectively disseminate safe sex information through networks of gay men, homeless youth in key network positions could be recruited to disseminate prosocial and/or low-risk behaviors through the networks of homeless youth.

To better understand how to best implement network-level interventions for homeless youth, the nature of the social networks of homeless youth must be better understood, and our models of such networks need to be refined. Future studies should seek to better understand how density of networks affects behaviors. Moreover, other network properties, such as centrality, should be crucial to the dissemination models we are suggesting. Central network positions are ideal entry points for interventions that intend to utilize social influence processes in a positive way. Finally, how the behaviors of particular members of a network and their positions in the network affects influence and dissemination processes must be better understood to most effectively design interventions to help these young people.

Acknowledgments

The National Institute of Mental Health Grants No. 1RO1 MH61185, R01 MH49958-04, and P30MH58107 supported this study.

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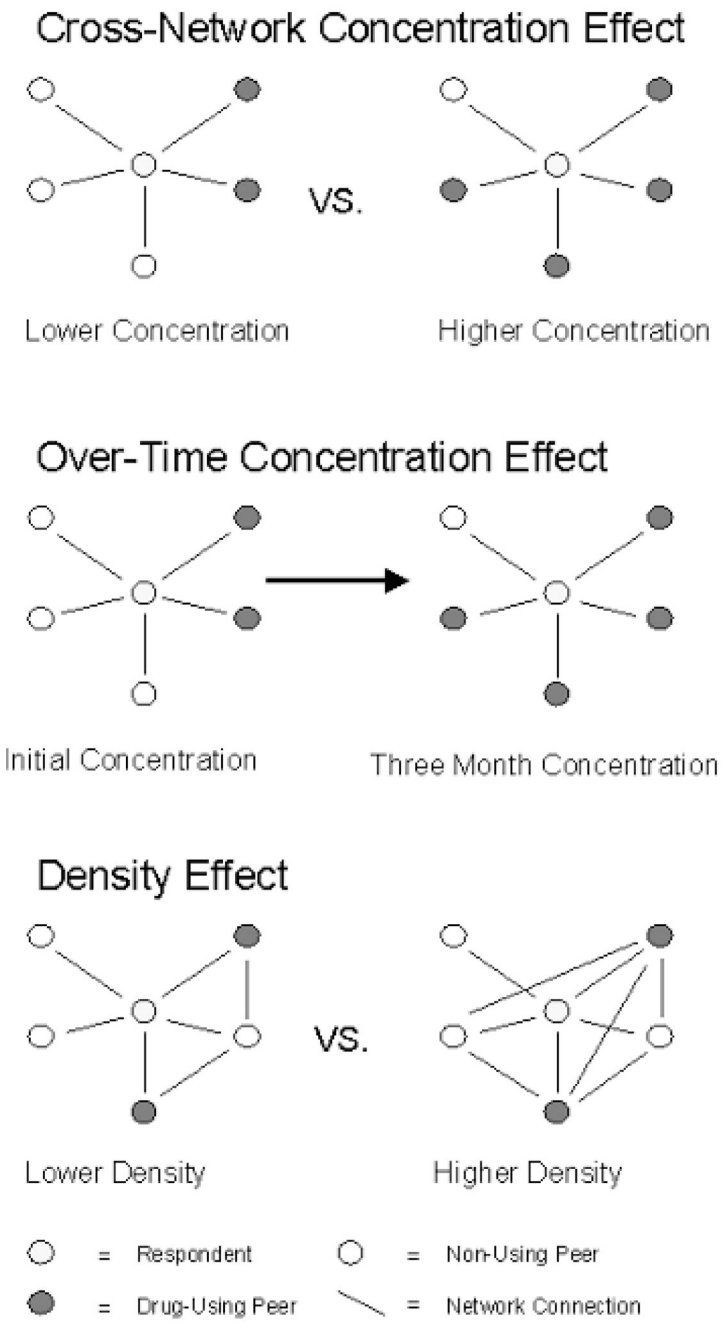

Figure 1.
Social Network Properties and Drug Use

TABLE 1

Drug Use at Baseline and 3 Months, American and Australian Youth

	United States (n = *217*)		*Australia* (n = *119*)	
Variable	**%**	**n**	**%**	**n**
Amphetamine use				
Baseline	26.89	32	14.75	32
3 months	11.98	26	28.81	34
Cocaine use				
Baseline	20.28	44	9.32	11
3 months	15.67	34	9.32	11
Injection drug use				
Baseline	2.30	5	4.24	5
3 months	3.69	8	6.78	8

TABLE 2

Characteristics of Homeless Young People, 3-Month Follow-Up, United States and Australia

	United States (n = *217*)		*Australia* (n = *119*)		t *Stat*
Variable	**M**	**SD**	**M**	**SD**	***(Chi-Square)***
Background characteristics					
Age	15.45	1.85	16.92	1.39	7.53**
Gender (% male)	41.01		41.18		(0.00)
Baseline behavior (%)					
Amphetamine user	20.89		14.75		(7.35)**
Cocaine user	20.28		9.32		(6.68)**
Injection drug user	2.30		4.24		(0.99)
Network properties					
Concentration of injecting friends	1.27	0.46	1.34	0.47	1.28
Change in concentration	−0.08	0.61	−0.09	0.54	0.16
Concentration of homeless friends	1.42	0.69	1.52	0.48	1.32
Change in concentration	−0.21	0.60	−0.03	0.69	2.45*
Density	2.85	0.57	2.88	0.52	0.55

* $p < .05$.

** $p < .01$.

TABLE 3

Effects of Network Properties on Amphetamine Use at 3 Months, United States and Australia

	Model 1			Model 2		
Variable	**Beta**	**Odds Ratio**	**95% Confidence Interval**	**Beta**	**Odds Ratio**	**95% Confidence Interval**
Background characteristics						
Age (years)	0.06	1.06	0.84, 1.34	0.08	1.08	0.87, 1.34
Gender (male = 1)	−0.32	0.73	0.36, 1.49	−0.61	0.54	0.26, 1.12
Site (United States = 1)	−0.80*	0.45	0.21, 0.95	−0.81*	0.45	0.21, 0.93
Baseline behavior (user =1)						
Amphetamine user	2.29**	9.90	4.83, 20.29	2.62**	13.74	6.84, 27.63
Network properties						
Concentration of injecting friends	0.46	1.59	0.79, 3.20			
Change in concentration				0.42	1.52	0.86, 2.70
Concentration of homeless friends	0.73**	2.08	1.18, 3.65			
Change in concentration				0.07	1.07	0.65, 1.79
Density	0.63*	1.88	0.94, 3.79			
Hosmer-Lemeshow test						
Chi-square	5.11			7.87		
df	8			8		
p > chi-square	0.75			0.45		
−2 log likelihood	213.32			224.23		

* $p < .05$.

** $p < .01$. One-tailed *t* test.

TABLE 4

Effects of Network Properties on Cocaine Use at 3 Months, United States and Australia

	Model 1			Model 2		
Variable	**Beta**	**Odds Ratio**	**95% Confidence Interval**	**Beta**	**Odds Ratio**	**95% Confidence Interval**
Background characteristics						
Age (years)	−0.08	0.93	0.73, 1.18	−0.07	0.94	0.75, 1.17
Gender (male = 1)	−0.29	0.75	0.34, 1.65	−0.49	0.61	0.27, 1.37
Site (United States = 1)	0.30	1.35	0.55, 3.31	0.25	1.28	0.51, 3.19
Baseline behavior (user =1)						
Cocaine user	2.40**	11.01	5.11, 23.72	2.50**	12.20	5.68, 26.22
Network properties						
Concentration of injecting friends	0.29	1.34	0.63, 2, 87			
Change in concentration				0.76**	2.14	1.18, 3.89
Concentration of homeless friends	0.60*	1.82	1.01, 3.27			
Change in concentration				−0.22	0.81	0.45, 1.45
Density	0.60*	1.81	0.91, 3.63			
Hosmer-Lemeshow test						
Chi-square	4.55			5.96		
df	8			8		
p > chi-square	0.80			0.65		
−2 log likelihood	194.88			195.79		

* $p < .05$.

** $p < .01$. One-tailed *t* test.

TABLE 5

Effects of Network Properties on Injection Drug Use at 3 Months, United States and Australia

	Model 1			Model 2		
Variable	**Beta**	**Odds Ratio**	**95% Confidence Interval**	**Beta**	**Odds Ratio**	**95% Confidence Interval**
Background characteristics						
Age (years)	−0.03	0.97	0.66, 1.43	0.06	1.06	0.74, 1.53
Gender (male = 1)	−1.25	0.29	0.06, 1.42	−1.03	0.36	0.09, 1.14
Site (United States = 1)	−0.59	0.55	0.14, 2.15	−0.45	0.64	0.18, 2.30
Baseline behavior (user =1)						
Injection drug user	2.64**	14.04	2.86, 68.99	2.68**	14.65	2.94, 73.00
Network properties						
Concentration of injecting friends	0.96*	2.62	0.91, 7.52			
Change in concentration				0.66	1.93	0.88, 4.22
Concentration of homeless friends	−0.25	0.78	0.23, 2.57			
Change in concentration				0.69*	2.00	0.94, 4.26
Density	−0.07	0.93	0.29, 2.98			
Hosmer-Lemeshow test						
Chi-square	7.23			7.47		
df	8			8		
p > chi-square	0.51			0.49		
−2 log likelihood	92.98			97.88		

* $p < .05$.

** $p < .01$. One-tailed *t* test.