Published in final edited form as:
Am J Prev Med. 2007 June ; 32(6 Suppl): S203–S210.

Neighborhood Socioeconomic Status, Personal Network Attributes, and Use of Heroin and Cocaine

Chyvette T. Williams, PhD[1] and **Carl A. Latkin, PhD**[2]

1*School of Public Health, University of Illinois at Chicago, Chicago, Il*

2*Department of Health Policy and Management, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD*

Abstract

Background—Drug abuse is a significant public health problem because of its association with numerous negative health and social consequences. Examining the social context of drug use represents a burgeoning avenue of research in drug abuse. This study investigates the effects of neighborhood disadvantage and network factors on current heroin and cocaine use among a predominantly African-American adult sample residing in Baltimore City.

Methods—This study employs a cross-sectional, multilevel design using data from two sources: the SHIELD Study, a network-oriented HIV intervention in Baltimore City and the 1990 US Decennial Census. The sample consisted of 1305 adults from 249 neighborhoods (census block groups) across Baltimore City. Multilevel logistic regression analysis was performed to examine personal network and neighborhood effects on current heroin and cocaine use.

Results—Neighborhood poverty was significantly associated with current heroin and cocaine use (OR=1.51, CI: 1.06, 2.15). Social support (OR=0.80, CI: 0.69, 0.92) and having ties to employed persons (OR=0.47, CI: 0.24, 0.92) were protective of current drug use, but did not buffer negative effects of neighborhood poverty in the face of negative drug influences in the network (OR=8.62, CI: 5.81, 12.79).

Conclusions—The contexts of neighborhoods and networks represent key determinants in understanding the social epidemiology of drug abuse. Network attributes have strong influences on drug use and neighborhood poverty may increase odds of use. Further research is warranted to determine other aspects of neighborhood environments that may put individuals at risk for drug use and abuse.

INTRODUCTION

Abuse of illicit substances, such as heroin and cocaine, continues to be a significant public health issue. Drug-related complications and injuries contribute approximately $12 billion to our national health care bill and represent a significant contributing factor to our nation's mortality toll via injury, overdose, HIV/STIs, liver and cardiovascular diseases. [1,2] In addition to severe health consequences, the social consequences of drug abuse are also significant and may include productivity loss, increased crime and imprisonment, and mental and physical

Correspondence and reprint requests: Chyvette T. Williams, PhD, University of Illinois at Chicago, School of Public Health, 1603 West Taylor Street, MC923, Chicago, Il 60612, Phone: (312) 355-5299; Fax: (312) 996-5356; E-mail: chevy@uic.edu

No financial conflict of interest was reported by the authors of this paper.

disability.[1,2,3,4] Moreover, negative consequences are more probable and severe with use of more highly addictive substances such as heroin and cocaine, as opposed to marijuana.[5,6]

Because drug use is a social behavior, determining its etiology necessitates examination of the social context within which the behavior occurs. One's partner status and employment status provide key social contexts for drug use and abuse.[7] For example, individuals with partners and/or children are less likely to use drugs, unless their partner also uses. Because employed persons have more structured time, have more contact with mainstream individuals, and derive more meaning and purpose from life through work, they are at decreased risk of drug abuse and dependence.[8]

Other social contexts important for drug abuse are families and peers. Research has shown that drug use is initiated and supported in family and peer networks that have a history of drug involvement.[9] Embeddedness in active drug networks, therefore, creates a context that reinforces and sustains drug use. Conversely, ceasing drug use is often facilitated by disassociating from drug-using peers and receiving support from network members that have more prosocial orientations or that are not drug-involved.[10] The provision of social support is an important function of networks because of its health-enhancing and stress-buffering effects. For drug use and abuse, social support, when not enabling, has been shown to facilitate drug use reduction and cessation.[11,12] The level and type of prosocial support one receives depends on the nature of his social ties.

Neighborhood environments represent a more distal social context that capture physical and economic features of one's environment, and structures network composition and relations. Determining if and to what extent neighborhood socioeconomic characteristics, in particular, affect health has dominated research literature primarily because of the well-established literature demonstrating consistent and robust associations between socioeconomic status and health at the individual level. The research on neighborhoods and health to date has shown fairly consistent, but low to modest relationships between neighborhood socioeconomic conditions and a range of disease outcomes and health behaviors, including drug use. For example, research from the *Fighting Back* program (Robert Wood Johnson Foundation) has revealed that neighborhood disadvantage is significantly associated with drug use and dependence, but to a lesser degree than with visible drug markets in neighborhoods.[13] Boardman and colleagues[14] explored relationships among neighborhood disadvantage, stress, psychosocial resources and adult drug use. The authors found only a marginal association between neighborhood disadvantage and adult drug use over and above individual-level stressors, social and psychological resources, and sociodemographics. Interacting neighborhood disadvantage with personal income, the authors found a more pronounced negative effect of neighborhood disadvantage on drug use for poorer respondents, suggesting cumulative risk for doubly disadvantaged individuals.

These studies found modest effects of neighborhood disadvantage on drug use using household samples. While household samples better represent the general population, they might exclude more disadvantaged community residents who may not be stable members of any one household because of their drug use and/or poverty status. This would underestimate the true association between neighborhood disadvantage and drug use for this group, as evidenced by the interaction effect Boardman and colleagues found. The current study assesses neighborhood and network effects on heroin and cocaine use among a disadvantaged population. Systematically examining network and neighborhood attributes together can help to characterize the social context in which adult drug use occurs. Few other studies have attempted to simultaneously examine neighborhood and network effects on drug use. A study by Schroeder and colleagues[15] examined neighborhood and network attributes as predictors of continuing drug use. In multivariate analyses, the authors found significant effects of drug-

related arrests on continued use, but no neighborhood SES effects. Of network attributes, having drug-using members predicted continued use, while social support was not associated with use. Though the study asked an important question, it was limited by its relatively small sample size and did not account for multilevel design of the data.

Thus, the current study improves upon past studies in important ways. First, past studies have been less comprehensive in their approach to measuring neighborhood disadvantage. This study explores the significance of one dozen socioeconomic indicators for drug use. Second, the sample draws from a more disadvantaged population for whom interventions might be more critically warranted. Third, this study targets an adult population, for whom neighborhood effects on drug use is less understood than for youth. Lastly, a multilevel analytic structure is employed to simultaneously examine two important social contexts for drug use, neighborhoods and personal networks.

METHODS

Data Sources

Data used were from two sources: the baseline survey of the SHIELD (Self-Help In Eliminating Life-threatening Diseases) Study and the US Census. The SHIELD Study (Baltimore, MD) is a network-oriented HIV prevention intervention targeting members of the drug-using community for HIV risk reduction. Individual-level sociodemographics and network characteristics were taken from the SHIELD Study. Block-group socioeconomic data from the US Census were used to construct neighborhood-level measures. Data collection for the SHIELD Study began in 1996, therefore, block-group data from the 1990 Census was used. Data analysis began in 2002.

Participant Recruitment

Targeted outreach and word-of-mouth were used to recruit participants from high-risk communities. Recruitment areas were identified through ethnographic observations, focus groups, and by geocoding the locations of all drug-related arrests in Baltimore during the three-year period prior to the beginning of the study. Potential participants were approached on the street and provided a brief written description of the study and a toll-free phone number to call if interested. Potential participants were briefly screened over the phone or on a walk-in basis. Eligibility criteria were: (1) being at least 18 years old, (2) having regular contact with drug users, (3) willingness to conduct peer outreach, and 4) willingness to bring in 1 to 2 network members. Eligible participants were asked to come to the project office for a baseline interview. The current investigation uses baseline data only; details about the study intervention are not reported here. All participants provided informed consent before enrollment and were financially compensated for their time. The study was approved by the Johns Hopkins Committee on Human Research.

Measures

The SHIELD baseline survey data represent self-reported responses to questionnaire items on individual and network characteristics and drug use behaviors. The outcome for this investigation is any use (versus no use) of heroin, cocaine, or crack within the past year. Age, gender, education, employment, and income were included as control variables. Additional covariates included participant's partner status (whether or not participant has a main sex partner), participant's score on a depression screening instrument, and self-reported HIV status. Depressive symptoms were measured using the Centers for Epidemiologic Studies – Depression (CES-D) scale. The CES-D is a validated 20-item, 4-point scale that was designed as a screening instrument for depression in the general population, and has been used successfully in studies with drug users.[16,17] Scores are calculated by summing all items in

the scale, after reverse-coding positive items. Cronbach's alpha for the list of items was 0.90. Scores ranged from 0 to 60 with higher scores indicating greater probability of depression. A score of 16 or higher has been validated as a cut-off for probable depression.[18] All individual variables were dichotomous.

All SHIELD participants completed a network inventory where they were asked to nominate individuals who were important to them in a number of ways. The network variables explored in this investigation assess characteristics of participants' total personal network (i.e. the total number of people named from all name-generating questions). Questions asked about personal characteristics of network members, network structure and relations, and social resources.

This investigation examined two network social resources: having ties to employed persons and social support provision. Participants were asked which of their network members had jobs. Being connected to persons who work was thought to reduce drug use by decreasing motivation and opportunity to use, and via increased contact with prosocial individuals. This variable was represented as the number of employed ties divided by total network size. The social support measure was adapted from Barrera's[19] social support scale and included a series of questions regarding types of support provided and the number of people providing such support. Social support was assessed with seven survey questions asking the number of persons the respondent has in his network who: (1) he could talk to about personal things; (2) he could hang out with; (3) would offer health advice; (4) would give up time or energy to help you; (5) would let him stay at their place; (6) would lend $25; and (7) he could trust with money. The Cronbach's alpha for the seven items was 0.85. The variables were summed and then divided by the total network size.

In addition, a measure of drug influence on the respondent was examined. Drug influence (embeddedness) was measured with three variables: number of people who provide support for drug use, number of injectors in the network, number of daily users in the network. The Cronbach's alpha for the three items was 0.76. The three variables were summed and then divided by the total network size.

Neighborhood-level data were constructed using variables from the 1990 US Census. Because of the scant literature surrounding area-level factors that are significant for drug use for adults, a total of 13 neighborhood-level variables were explored. Past studies have selected common socioeconomic variables for inclusion, often without clear rationale as to why some were included and others were excluded. The most common indicators seen across studies have been: percent in poverty, percent receiving public assistance, percent unemployment, percent with low educational level, percent female-headed households, median household income, and neighborhood disadvantage (as a composite measure). Indicators were selected based on (1) prior research examining effects of neighborhood socioeconomic indicators on health, (2) additional variables that were thought to be theoretically associated with drug use, and (3) significant bivariate relationships within the sample. So, in addition to the aforementioned indicators, several others were also explored: percent of persons not in the labor force, percent vacant housing, percent of blue collar and professional occupations, percent renters, and percent disabled.

All variables were initially constructed as percentages. Then they were standardized and the 12 neighborhood-level socioeconomic indicators were summed to create a measure of neighborhood disadvantage. Cronbach's alpha for the standardized scale was 0.85. Because some percentages were skewed, all 13 variables were dichotomized (high/low) at the median for consistency in interpretation across indicators.

Data preparation

Using ArcView 3.2[20], participant addresses were geocoded to a point location with 98% success and the corresponding Census block-group was determined for each. A total of 416 (50%) of Baltimore's 832 blockgroups were represented. Blockgroup-level socioeconomic variables were linked with individual and network attribute survey data to create the final working data set.

Observations with missing values for either survey or Census data were not included in final analyses. Further, in order to estimate within- and between-variances, there must be at least 2 observations within a blockgroup.[21] Blockgroups that did not meet this criterion were deleted. Therefore, the final level I sample size was 1305, and the final level II sample size was 249.

Statistical Techniques

Bivariate associations were assessed using chi-square or ANOVA, as appropriate, between all predictors (individual, network, and neighborhood) with the outcome, drug use (heroin, cocaine, crack) in the past year. Drug types were not analyzed separately because of considerable polydrug use within the sample. Variance inflation factors (VIFs) and correlations were assessed for all of the neighborhood-level indicators with each other to assess for multicollinearity. The mean VIF was 2.61 (range 1.3 – 4.6) and correlations ranged between 0.02 and 0.65. This step helped inform how the indicators should be entered into the model. Variables entered into multiple regression models were based on significant bivariate relationships and theoretical rationale. Prior to conducting multilevel analysis, fitting a random effects null model is necessary to determine if clustering exists by neighborhood. Results determined that drug use differed by neighborhood ($\chi 2 = 306.08$; $p=0.007$); therefore, we proceeded under the assumption of neighborhood-level clustering and multilevel models were fit to assess neighborhood effects. Network variables were not modeled as a separate level because they were not necessarily nested within neighborhoods and they were conceived as attributes of individuals. The Stata[22] statistical software package was used for exploratory analysis and HLM[21] was used to construct and test hierarchical logistic regression models using the Laplace-6 approximation of maximum likelihood for more accurate and efficient estimates.

RESULTS

Sociodemographic Characteristics of Participants

Presented in Table 1 are descriptive statistics of participant demographic and network characteristics by drug use. Seventy-five percent of participants reported using heroin, crack and/or cocaine in the past year. All participants reported lifetime history of some drug use and 49% of the sample were drug injectors, all of which were current users (data not shown). The mean age of the sample was 38, which is consistent with reports from the Office of National Drug Control Policy regarding the average age of Baltimore City drug users.[24,25] Current drug users, however, were significantly more likely to be older than the mean age. Females comprised 39% of the sample. Just over half of participants (53%) had achieved a high school education, which was marginally associated with reporting current drug use. Approximately 80% and 70%, respectively, reported not working and having monthly incomes less than $500. Most participants (60%) reported having a main (sexual) partner. Depressive symptoms scores were at or above the threshold for clinical depression for 60% of the sample; and were associated with current drug use. Eighteen percent self-reported being HIV positive.

Network Characteristics of Participants

Network attributes of participants are listed at the bottom of Table 1. The average size of participants' networks was 9 (range: 2, 20). The values for negative drug influence ranged from 0 to 3, with 0 meaning no drug influence in the network and 3 indicating a fully saturated network of drug influence (mean = 1.03). Other network composition attributes examined were the percent of ties to employed individuals and social support. The average composition of working individuals in any participant's network was 42%; thus, for a mean network size of 9, approximately 3 or 4 network members would be employed. Social support was measured with seven indicators. The range of possible values was 0 to 7, with 0 representing complete lack of social support and 7 indicating that every member of the network would provide support on all the items. The actual range of values seen in the data was from 0.1 to 7, suggesting a full range of support. The mean level of support was 2.38, indicating rather low support on average.

Characteristics of Participants' Neighborhoods

Table 2 displays descriptive statistics for the 249 neighborhoods represented. Descriptive values of the 12 neighborhood socioeconomic indicators for the 249 study neighborhoods are also compared with the mean values of all Baltimore City neighborhoods. Overall, participants' neighborhoods appear to be fairly disadvantaged, but there exists a considerable range in the degree of disadvantage.

Tests of proportions between participants' neighborhoods and all city neighborhoods revealed significant differences for 6 of the 12 indicators—education, female-headed households, public assistance, renters, poverty, and median household income. These differences suggest that the neighborhoods in the sample are significantly more disadvantaged on these 6 indicators. These differences limit the ability to generalize findings to a random sample of Baltimore drug users. This, however, is of limited concern as the general aim of the study is to describe the neighborhood effects for a predominantly African-American sample of disadvantaged inner-city drug users.

Multilevel Correlates of Drug Use

Table 3 depicts the results of several multilevel models fitted (i.e. all models were fit estimating random intercepts). Model I lists the results from entering only individual characteristics. Model II builds on Model I by adding the network variables of interest. For Model III, individual characteristics with significant neighborhood-level variables were modeled, excluding network attributes. Finally, in Model IV, all significant personal, network, and neighborhood factors that are correlated with current heroin/cocaine use were listed.

Personal Correlates of Drug Use

The odds of reporting use of heroin and/or cocaine in the past year was higher for individuals above the mean age (OR=1.49, $p<0.01$) and were not associated with gender. None of the individual socioeconomic variables (employment, education, income) were related to current drug use. Individuals reporting having a main (sexual) partner were more likely to report current drug use (OR=1.40, $p<0.05$). Consistent with the literature, the odds of current drug use were 2.5 times higher for individuals who had depressive symptom scores higher than 16 (an indication of depression) (OR=2.42, $p<0.01$). Individuals who self-reported being HIV-positive were less likely than HIV-negative individuals to report current drug use (OR=0.670, $p<0.05$).

Network Correlates of Drug Use

This study assessed the effects of three important network attributes: drug influence (a combined measure of drug-using ties, support for drug use, and connection to daily users), ties

to employed persons, and social support. Consistent with the literature, having an overabundance of drug influences in one's network was significantly related to reporting current drug use. In fact, the odds of reporting current drug use for individuals with stronger drug influences was 8.5 times higher than for individuals with less strong drug influences. The network variable, proportion of employed ties, was determined to be rather strongly associated with no current drug use (OR=0.45, $p<0.05$). Finally, a high level of social support was significantly associated with reporting no drug use in the past year (OR=0.80, $p<0.01$). We also fit models that included interactions between drug influence and the two prosocial network attributes and found no evidence to support such an effect.

Neighborhood Socioeconomic Correlates of Drug Use

Multilevel models were fit entering each neighborhood socioeconomic indicator individually into a model that adjusted for significant personal characteristics. Only one indicator, neighborhood poverty, was statistically related to individual drug use while controlling for significant personal characteristics (Table 3, Model III). The odds of reporting heroin, crack and/or cocaine use in the past year was 52% higher for participants who lived in a neighborhood where at least one-third of the residents were living in poverty. In Model IV, we fit the full final multilevel model and find that the effect of neighborhood poverty on current drug use remains after adjusting for significant individual and network characteristics.

Because drug influence could negatively counteract the potential benefits of strong social support and having ties to employed individuals, we also fit a model with only the positive network attributes to see if it mitigated the negative effects of neighborhood poverty. The estimate of the effect of neighborhood poverty did not change significantly. Additionally, fitting a model with drug influence as the only network variable yielded an almost identical result to those presented in Table 3, Model IV with the positive network variables in the model.

DISCUSSION

The results of this study are consistent with the limited research showing negative effects of neighborhood disadvantage on drug use. Neighborhood poverty and drug influences in the network were found to be positively associated with current drug use, while network social support and having ties to employed persons were protective of current drug use. Further, it was found that the effect of neighborhood poverty is robust in the sense that its effects are not attenuated when network attributes are taken into account. This study builds upon past research, however, by examining this association among a predominantly African-American community sample of adults recruited at the street-level. The significance of studying drug use among a street-recruited sample is important because members of these samples represent a very different population from household samples. Street-recruited drug users usually are more marginalized, economically disadvantaged, and may have more serious drug-related problems. Therefore, the effects of neighborhood environment may be different for this group; and understanding whether and how the context impacts them has important implications for intervention.[26] Further, socioeconomic indicators that have not been examined in relation to drug use, but that have plausible theoretical association were explored. In exploring these additional indicators, such as percent of vacant housing and disability, no significant associations were found.

For drug outcomes, evidence that neighborhood environment is critically important for use, abuse, or cessation is still somewhat lacking. Given the level of poverty in the study sample, those who ceased drug use may not have been able to move out of disadvantaged neighborhoods. Further, because there are such high rates of drug use in Baltimore and there is little residential choice for poor individuals, neighborhoods may not appear to be as strong of a determinant and this may have diminished neighborhood effects. Saxe and colleagues[13]

argued that the visible drug sales in disadvantaged neighborhoods is a bigger problem than drug use and dependence, and this may also help explain lack of neighborhood effects. Clearly, more research on what aspects of the neighborhood environment are important for adult drug use is crucial, as they may not be the typical socioeconomic indicators. Neighborhood features such as liquor stores may be important. Liquor stores have been examined in relation to alcohol use, but not drug use. In Baltimore City, many drug markets are located near liquor stores, which we know are more abundant in poor and minority neighborhoods.[27] Policing patterns, which vary by neighborhood, are also associated with drug markets.[28] In addition to identifying socioeconomic risks for use, research should also begin to examine the presence of neighborhood institutions, such as churches and community-based organizations, and their impact on drug use and abuse.

Consistent with health literature, network attributes are considerably important for drug outcomes. Perhaps the most intriguing finding of the study is the effect of having ties to employed persons on current drug use. Having ties to employed persons significantly reduced the likelihood of reporting current drug use. As expected, individuals who were employed were more likely to report having ties to employed persons. Though we were unable to tease apart the directionality of the association, much research has also demonstrated the protective health effects of employment.[8] Further, anecdotal evidence tells us that most drug users want to work, and once working, they might reduce their use and make other positive changes in their lives.[29] Given the study's finding around employment, job training opportunities and the creation of mid-skilled jobs in communities might help reduce drug use.

The other network variables, drug influence and social support, were significantly associated with drug use in the expected directions. Of all multilevel variables, pro-drug influences were related most strongly with drug use. While it may be argued that drug users seek ties with others who use drugs and support their use, self-selection does not negate the reinforcing effects of networks via psychosocial processes of norms and other cues to use. Social support, as an independent main effect, significantly decreased the odds of current use; however, it was deemed ineffective as both a buffering agent of a disadvantaged environment and of strong drug network influences since it neither attenuated the effect of negative contexts on drug use nor had significant interaction effects. Given this finding, interventions need to focus both on strengthening social support and disassociating from drug-using ties, in addition to trying to reintegrate marginalized users into mainstream society through employment or work programs.

There are several limitations in this study. First, the study uses cross-sectional data, therefore, causal interpretations cannot be made regarding the associations; and the reporting of odds ratios are not to be interpreted as estimates of relative risk. Qualitative data from the study suggests that the probability of the drift hypothesis (that residents originally lived in more affluent areas and drifted to poorer areas because of their drug use) explaining the relationship between neighborhood poverty and current drug use is not likely. Second, the range of types of neighborhoods from which participants were recruited was restricted to areas with high levels of drug problems. Concomitantly, these also tend to be areas that are more economically disadvantaged and have a higher composition of African-Americans.[30] This limits the ability to generalize to a larger, more economically and racially diverse population; however, doing so was not the aim of this study. We were specifically interested in assessing neighborhood effects on disadvantaged drug users—a group for which the effects of neighborhood environment are unknown but that may represent a context posing significant risks for increased drug use and other risk behaviors. Therefore, we believe the results represent and can be generalized to similarly disadvantaged, African-American drug users living in urban areas comparable to Baltimore City. Lastly, as with most studies, this study relies upon self-reports of drug use. Research on the reliability of drug use self-reports suggest, however, that self-reports are typically good measures of drug use.[31,32]

Notwithstanding these limitations, we feel this research makes a much needed contribution to understanding the social epidemiology of drug abuse by assessing two important contexts—networks and neighborhoods—on the drug use of disadvantaged adults. Further, because this study focuses on disadvantaged African-Americans, the results also contribute to understanding racial and socioeconomic disparities in drug use and its consequences. While this study adds to the current literature, much more research is warranted to understand the aspects of social and physical environments that matter for drug outcomes before effective policy and research interventions can be developed.

ACKNOWLEDGMENTS

Funding support for this research came from the National Institute on Drug Abuse, National Institutes of Health, Grant Nos. F31 DA14447, R01 DA10446, R01 DA13142. The authors would like to thank all SHIELD project staff for their efforts in recruiting participants and collecting and managing the data for the project.

REFERENCES

1. Robert Wood Johnson Foundation. Substance Abuse: The Nation's Number One Health Problem. Brandeis University: Prepared by Schneider Institute for Health Policy; 2001 Feb.
2. Hser Y-I, Hoffman V, Grella CE, Anglin MD. A 33-year follow-up of narcotics addicts. Archives of General Psychiatry 2001;58:503–508. [PubMed: 11343531]
3. Bray JW, Zarkin GA, Dennis ML, French MT. Symptoms of dependence, multiple substance use, and labor market outcomes. Am J Drug Alcohol Abuse 2000;26:77–95. [PubMed: 10718165]
4. Peterson, GE.; Harrell, AV., editors. Drugs, Crime and Social Isolation: Barriers to Urban Opportunity. Washington, DC: Urban Institute Press; 1992.
5. Stein MD. Medical consequences of substance abuse. Psychiatric Clinics of North America 1999;22:351–370. [PubMed: 10385938]
6. Hall W, Solowij N. Adverse effects of cannabis. The Lancet 1999:1611–1616.
7. Substance Abuse and Mental Health Services Administration. Office of Applied Studies, NHSDA Series H-21, DHHS Publication No. SMA 03–3774. Rockville, MD: 2003. Overview of Findings from the 2002 National Survey on Drug Use and Health.
8. Sterling RC, Gottheil E, Glassman SD, Weinstein SP, Serota RD, Lundy A. Correlates of employment: a cohort study. Am J Drug Alcohol Abuse 2001;27:137–146. [PubMed: 11373031]
9. Valente TW, Gallaher P, Mouttapa M. Using social networks to understand and prevent substance use: a transdisciplinary perspective. Substance Use & Misuse 2004;39:1685–1712. [PubMed: 15587948]
10. Latkin CA, Knowlton AR, Hoover D, Mandell W. Drug network characteristics as a predictor of cessation of drug use among adult injection drug uses: A prospective study. American Journal of Drug and Alcohol Abuse 1999;25:463–473. [PubMed: 10473009]
11. Havassy BE, Wasserman DA, Hall SM. Social relationships and abstinence from cocaine in an American treatment sample. Addiction 1995;90:699–710. [PubMed: 7795506]
12. Wasserman DA, Stewart AL, Delucchi KL. Social support and abstinence from opiates and cocaine during opioid maintenance treatment. Drug Alcohol Depend 2001;65(1):65–75. [PubMed: 11714591]
13. Saxe L, Kadushin C, Beveridge A, Livert D, Tighe E, Rindskopf D, Ford J, Brodsky A. The visibility of illicit drugs: Implications for community-based drug control strategies. American Journal of Public Health 2001;91:1987–1994. [PubMed: 11726381]
14. Boardman JD, Finch BK, Ellison CG, Williams DR, Jackson JS. Neighborhood disadvantage, stress, and drug use among adults. Journal of Health and Social Behavior 2001;42(2):151–165. [PubMed: 11467250]
15. Schroeder JR, Latkin CA, Hoover DR, Curry AD, Knowlton AR, Celentano DD. Illicit drug use in one's social network and in one's neighborhood predicts individual heroin and cocaine use. Annals of Epidemiology 2001;11(6):389–394. [PubMed: 11454498]
16. Knowlton AR, Latkin CA, Shroeder JR, et al. Longitudinal predictors of depressive symptoms among low income injection drug users. AIDS Care 2001;13:549–559. [PubMed: 11571003]

17. Grella CE, Anglin MD, Annon JJ. HIV risk behaviors among women in methadone maintenance treatment. Substance Use & Misuse 1996;31:277–301. [PubMed: 8834263]
18. Boyd JH, Weissman MM, Thompson WD, et al. Screening for depression in a community sample. Understanding the discrepancies between depression symptom and diagnostic sales. Archives of General Psychiatry 1982;39:1195–1200. [PubMed: 7125849]
19. Barrera MJ, Ainlay SL. The structure of social support: A conceptual and empirical analysis. Journal of Community Psychology 1983;11:133–143. [PubMed: 10299305]
20. Environmental Systems Research Institute, Inc. (ESRI). ArcView GIS 3.2. software program. 1992–1999.
21. Snijders, T.; Bosker, R. Multilevel Analysis: An Introduction to Basic and Advanced Multilevel Modeling. London: Sage Publications; 1999.
22. StataCorporation. Stata Statistical Software, Release 7.0. College Station, TX: 2001.
23. Raudenbush, SW.; Bryk, A.; Congdon, R. HLM for Windows, Version 5.05. Scientific Software International, Inc. Lincolnwood, IL: 2001.
24. Office of National Drug Control Policy. Pulse Check: Trends in Drug Abuse. 2002 Apr.
25. Center for Substance Abuse Research (CESAR). Drug Early Warning System. The DEWS County Snapshot: Substance Abuse Trends In Baltimore City. 2002.
26. Kip KE, Peters RH, Morrison-Rodriguez B. Commentary on why national epidemiological estimates of substance abuse by race should not be used to estimate prevalence and need for substance abuse services at community and local levels. Am J Drug Alcohol Abuse 2002;28:545–556. [PubMed: 12211365]
27. LaVeist T, Wallace JM. Health risk and inequitable distribution of liquor stores in African American neighborhood. Soc Sci Med 2000;51:613–617. [PubMed: 10868674]
28. Johnson BD. Patterns of drug distribution: implications and issues. Subst Use Misuse 2003;38:1789–1806. [PubMed: 14582578]
29. Dickson-Gomez JB, Knowlton AR, Latkin CA. Values and identity: the meaning of work for injection drug users involved in volunteer HIV prevention outreach. Subst Use Misuse 2004;39:1259–1286. [PubMed: 15461021]
30. Ford J, Beveridge A. “Bad” neighborhoods, fast food, “sleazy” businesses, and drug dealers: Relations between the locations of licit and illicit businesses in the urban environment. J Drug Issues 2004;34:1–51.
31. Yacoubian GS Jr, Urbach BJ. To pee or not to pee: reconsidering the need for urinalysis. J Drug Educ 2002;32(4):261–270. [PubMed: 12556132]
32. Hamid R, Deren S, Beardsley M, Tortu S. Agreement between urinalysis and self-reported drug use. Subst Use Misuse 1999 Sep;34(11):1585–1592. [PubMed: 10468109]

Table 1.

Characteristics of sample (N=1305)

[[Participant characteristics|]]	[[|]]	No heroin and/or cocaine use (past year) *n* (%)	Heroin and/or cocaine use (past year) *n* (%)
[[Totals|]]	[[Totals|]]	[[326 (25.0)|]]	[[979 (75.0)|]]
[[Age|]] *	[[|]]	[[|]]	[[|]]
Younger than mean age (38 yrs) (0)	[[43.1|]]	[[164 (29.1)|]]	[[399 (70.9)|]]
Mean age (38) or older (1)	[[56.9|]]	[[162 (21.8)|]]	[[580 (78.2)|]]
[[Gender|]]	[[|]]	[[|]]	[[|]]
[[Male (0)|]]	[[60.9|]]	[[193 (24.3)|]]	[[602 (75.7)|]]
[[Female (1)|]]	[[39.1|]]	[[133 (26.1)|]]	[[377 (73.9)|]]
[[Education|]]	[[|]]	[[|]]	[[|]]
Less than high school (1)	[[47.4|]]	[[140 (22.6)|]]	[[478 (77.4)|]]
High school/GED or higher (0)	[[52.6|]]	[[186 (27.1)|]]	[[501 (72.9)|]]
[[Employment|]]	[[|]]	[[|]]	[[|]]
Unemployed or not looking (1)	[[79.1|]]	[[250 (24.2)|]]	[[782 (75.8)|]]
Employed full or part-time (0)	[[20.9|]]	[[76 (27.8)|]]	[[197 (72.2)|]]
[[Income|]]	[[|]]	[[|]]	[[|]]
Less than $500/month (1)	[[70.0|]]	[[223 (24.4)|]]	[[691 (75.6)|]]
$500 or more per month (0)	[[30.0|]]	[[103 (26.3)|]]	[[288 (73.7)|]]
Have main sexual partner	[[|]]	[[|]]	[[|]]
[[Yes (1)|]]	[[59.8|]]	[[183 (23.4)|]]	[[598 (76.6)|]]
[[No (0)|]]	[[40.2|]]	[[143 (27.3)|]]	[[381 (72.7)|]]
[[Depressive symptoms|]] *	[[|]]	[[|]]	[[|]]
CES-D score < 16 (0)	[[39.7|]]	[[176 (34.0)|]]	[[342 (66.0)|]]
CES-D score ≥ 16 (1)	[[60.3|]]	[[150 (19.1)|]]	[[637 (80.9)|]]
[[HIV status|]] *	[[|]]	[[|]]	[[|]]
[[Negative (0)|]]	[[82.5|]]	[[257 (23.9)|]]	[[820 (76.1)|]]
[[Positive (1)|]]	[[17.5|]]	[[69 (30.3)|]]	[[159 (69.7)|]]
[[NETWORK CHARACTERISTICS|]] [[|]]	[[|]] [[Mean (SD)|]]	[[|]] [[Mean (SD)|]]	[[|]] [[Mean (SD)|]]
[[Negative drug influence|]] *	[[1.03 (0.52)|]]	[[0.70 (0.39)|]]	[[1.14 (0.50)|]]
Percent ties to full-time employed*	[[0.42 (0.22)|]]	[[0.48 (0.23)|]]	[[0.40 (0.21)|]]
[[Social Support|]] *	[[2.38 (1.12)|]]	[[2.58 (1.18)|]]	[[2.32 (1.09)|]]

* $p<0.05$

Table 2.

Characteristics of study neighborhoods compared with all Baltimore City neighborhoods

[[Variable|]]	Study neighborhoods (*n*=249)		Baltimore City (*n*=832)[a]
[[|]]	[[Median|]] [b]	[[Mean (range)|]]	[[Mean (range)|]]
% Less than high school/GED	[[49.5|]]	[[47.6| (0, 84.2)]] *	[[40.4 (0, 100)|]]
[[% Unemployment|]]	[[13.4|]]	[[14.1 (0, 58.9)|]]	[[10.0 (0, 100)|]]
% Not in labor force	[[41.7]]]	[[42.6 (2.5, 83.3)|]]	[[39.4 (0, 100)|]]
[[% Vacant housing|]]	[[10.6|]]	[[12.4 (0, 57.0)|]]	[[9.0 (0, 72.3)|]]
[[% Female-headed households|]]	[[54.9|]]	[[53.4| (0, 100)]] *	[[38.9 (0, 100)|]]
% Receiving public assistance	[[26.9|]]	[[27.6| (0, 69.2)]] *	[[18.0 (0, 100)|]]
% Blue collar workers	[[19.1|]]	[[19.1 (0, 51.1)|]]	[[16.8 (0, 100)|]]
[[% Renters|]]	[[68.7|]]	[[66.3| (1.3, 100)]] *	[[48.2 (0, 100)|]]
% Living in poverty	[[32.3]]]	[[33.0| (0, 85.4)]] *	[[21.5 (0, 85.4)|]]
[[% Professional workers|]]	[[13.6|]]	[[16.8 (0, 66.7)|]]	[[22.0 (0, 100)|]]
[[% Disabled|]]	[[14.1|]]	[[15.5 (0, 48.4)|]]	[[12.1 (0, 48.4)|]]
[[Median Household Income|]]	[[18854|]]	[[18834| (4999, 47639)]] *	[[25341 (0, 106939)|]]

[a] Complete data not available for all indicators. *n* ranges from 814–832. Significance tests based off *n*=832.

[b] Indicators were dichotomized at the median for analyses

* indicates value significantly different from Baltimore City value; α = 0.05

Table 3.

Final multilevel model of neighborhood, network, and individual correlates of adult drug use

[[Variable|]] [[|]]	[[Model I|]] [[OR (CI)|]]	[[Model II|]] [[OR (CI)|]]	[[Model III|]] [[OR (CI)|]]	[[Model IV|]] [[OR (CI)|]]
[[Personal characteristics|]]	[[|]]	[[|]]	[[|]]	[[|]]
[[Age|]]	[[1.49 (1.13, 1.96)|]]	[[1.57 (1.18, 2.10)|]]	[[1.51 (1.15, 1.99)|]]	[[1.62 (1.21, 2.18)|]]
[[Gender|]]	[[0.75 (0.55, 1.02)|]]	[[0.74 (0.53, 1.04)|]]	[[0.75 (0.55, 1.02)|]]	[[0.74 (0.53, 1.044)|]]
[[Partner status|]]	[[1.40 (1.02, 1.91)|]]	[[1.48 (1.06, 2.07)|]]	[[1.40 (1.03, 1.92)|]]	[[1.49 (1.06, 2.09)|]]
[[Depressive symptoms|]]	[[2.42 (1.81, 3.23)|]]	[[1.84 (1.37, 2.47)|]]	[[2.39 (1.79, 3.20)|]]	[[1.83 (1.36, 2.46)|]]
[[HIV status|]]	[[0.67 (0.45, 0.99)|]]	[[0.68 (0.45, 1.01)|]]	[[0.67 (0.45, 0.99)|]]	[[0.67 (0.45, 1.01)|]]
[[Neighborhood indicators|]]	[[|]]	[[|]]	[[|]]	[[|]]
[[Poverty|]]	[[|]]	[[|]]	[[1.52 (1.09, 2.12)|]]	[[1.51 (1.06, 2.15)|]]
[[Network attributes|]]	[[|]]	[[|]]	[[|]]	[[|]]
[[Drug influence|]]	[[|]]	[[8.50 (5.74, 12.60)|]]	[[|]]	[[8.62 (5.81, 12.79)|]]
[[Job tie|]]	[[|]]	[[0.45 (0.23, 0.88)|]]	[[|]]	[[0.47 (0.24, 0.92)|]]
[[Social support|]]	[[|]]	[[0.80 (0.70, 0.92)|]]	[[|]]	[[0.80 (0.69, 0.92)|]]

CI, confidence interval; OR, odds ratio