Published in final edited form as:

Am J Prev Med. 2007 June ; 32(6 Suppl): S234–S241.

Direct and Indirect Associations of Neighborhood Disorder with Drug Use and High-Risk Sexual Partners

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Abstract

Background—On a macrosocial level, neighborhood characteristics have been found to be associated with the prevalence of HIV and other bloodborne and sexually transmitted infections (STIs). The current study used structural equation modeling (SEM) to examine the relationship between neighborhood social and physical disorder and high risk sexual partners.

Methods—A cohort (N=838), recruited for an HIV prevention study of drug users (2002-2004) in Baltimore, Maryland, was interviewed about their neighborhood characteristics, drug use, depressive symptoms (CES-D), and HIV/STI risk behaviors of exchanging sex for money or drugs, having multiple sexual partners, and having partners who injected drugs or smoked crack cocaine. Data were analyzed in February 2005.

Results—Model fit statistics from Mplus indicated statistically significant direct associations between neighborhood disorder and psychological distress, neighborhood disorder and sexual risk behaviors, and neighborhood disorder and drug use. There were also significant indirect associations of neighborhood disorder on sexual risk behaviors.

Conclusions—These results highlight the importance of viewing drug use, chronic stress, depression and hopelessness, and infectious diseases such as HIV and hepatitis C as interlinked epidemics that are fostered by neighborhood social and physical disorder. Neighborhood, network, and community level interventions are needed to address these intertwined public health issues.

INTRODUCTION

Within U.S. inner-city communities, macrosocial factors such as racial segregation, discrimination, and economic deprivation have contributed to health disparities.^{1, 2} These factors have been exacerbated in many urban areas due to an out migration of social capital.^{3, 4} High levels of incarceration in urban areas lead to high network turnover and reduce employment prospects.⁵⁻⁷ Although there is ample evidence that health disparities are often based on socioeconomic status, few studies have documented pathways through which

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

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macrosocial factors may lead to infectious disease transmission.⁸⁻¹⁰ This study examines several mechanisms that may help to explain how neighborhood factors lead to individuals' sexual risk behaviors. Structural equation modeling (SEM) was used to examine the relationship between neighborhood characteristics, depressive symptoms, drug use, and sexual partner types among a sample of urban inner-city individuals with a history of substance abuse. Sexual partner types examined included those who smoked crack cocaine, injected drugs, exchanged sex, or were multiple sexual partners.

Networks

One explanation for the disproportionate levels of HIV in impoverished urban areas is social network dynamics. Social network factors have been found to be associated with HIV and sexually transmitted infections transmission.¹¹ Network structural characteristics (e.g. network density and connectivity) and dynamics (e.g., partner concurrency) may lead to sustained high rates of disease.^{12, 13} Network dynamics have also been used to explain racial differences in HIV rates.^{14, 15} The network construct of homophily, or assortative mating, indicate that individuals choose partners who are similar to themselves. Hence, drug users would be more likely than non-users to have drug-using sex partners. This assortative mating may be drug specific (i.e. injectors affiliating with other injectors) or a more general affiliation dynamic such as injectors affiliating with crack smokers.

Opportunity

Another factor that may lead to disease transmission is structured opportunities to engage in risk behaviors. Numerous studies have found that opportunity structures have a significant impact on the amount and type of criminal behavior.¹⁶ Even suicide rates have been found to be linked to opportunities. When the carbon monoxide levels of gas used in kitchen ranges decreased in the UK during the 1960s and 1970s, there was a marked decrease in the number of suicides due to carbon monoxide poisoning.¹⁷ During this period, there was not a compensatory increase in suicides by other means. In urban impoverished areas with high rates of opiate and cocaine use, there are greater opportunities to have sexual partnerships with crack users and injectors. Also, due to the high levels of incarceration among urban minorities there are fewer opportunities to have lower risk partners.

Geography

Several studies have confirmed an association between residential location and physical health and mortality, independent of individual socioeconomic status.¹⁸⁻²⁰ There are several characteristics of urban neighborhoods that may have toxic effects on health, including crime, physical decay, litter, drug use, residential mobility, unemployment, and crowding. Studies have consistently found that STI and HIV are geographically clustered.²¹⁻²² Disadvantaged communities have been found to be associated with higher area rates of STIs and early sexual initiation.²³⁻²⁴ One analysis of geographic areas in the U.S. found that counties with the largest proportional increased number of AIDS cases had lower levels of income and education, and higher rates of infant mortality, low weight births, and age-adjusted mortality.²⁵ Another study found that geographic clustering of STIs in deprived neighborhoods persisted, even after accounting for individual level characteristics like risk behaviors and socioeconomic status.²⁶

Geography and drug use

Illicit drug use and drug purchasing are major contributing factors to social disorder in urban neighborhoods.²⁷⁻²⁹ The association between drug use and criminal activities is well established^{30, 31} as is the association between crime and neighborhoods with social disorder.^{32, 33} Social disorganization theory also suggests a dynamic of crime leading to an exodus of individuals with resources from impoverished neighborhoods.²⁹ Those left behind do not have

the resources to prevent physical and social incivilities, which leads to greater concentrations of poverty, crime, drug use, and urban decay.

Neighborhood stressors

Fear of crime, drug markets, physical decay, crowding, noise, and pollution may provoke a physiological stress response.^{34, 35} Stress responses have been linked to impaired immune function.^{36, 37} Pearlin has emphasized the importance of stress as a social process, and labeled as “ambient strains” environmental stressors such as poverty and residing in high crime neighborhoods.³⁸ The concept of stress proliferation suggests that stressors are not independent events.³⁹ Rather, individuals who experience initial stressors are likely to be subjected to more frequent and severe stressors. Disadvantaged neighborhoods can be considered loci of stress proliferation exacerbated by the syndemics of HIV, HCV, violence, substance abuse, and poverty.^{4, 40}

Prior studies have found that chronic social and environmental stressors are associated with psychosomatic symptoms, and signs of learned helplessness, especially in poor urban populations. Individuals under chronic stress have stronger reactions to acute stressors. Also, compared to acute stressors, chronic stressors have a more pronounced influence on mental health.⁴¹⁻⁴³ Depressive symptoms have been linked to neighborhood disorder and economic disadvantage.⁴⁴⁻⁴⁶ Neighborhood disorder has also been found to predict subsequent depressive symptoms.⁴⁷ Neighborhood level stressors are often clustered, and highly impoverished neighborhoods may be the source of numerous chronic and acute stressors.⁴⁸

Stress, depression, and drug use

Depression has been linked with drug use, as both an antecedent and consequence.⁴⁹⁻⁵¹ One method of coping with stressors of poverty, violence, and physical illness is through drug use, which may blunt the appraisal of stress and negative emotional states. Depression may indirectly contribute to HIV through increased substance abuse. Individuals who are depressed are more likely to initiate drug use and are more likely to relapse.⁵² Depression has also been found to be associated with injection-related HIV risk behaviors.⁵³

The combination of substance use and dependence has its own dynamics that may lead to risky partner selection, including trading sex for drugs or money.⁵⁴⁻⁵⁵ Many inner-city drug users do not have the socially sanctioned life roles of marriage and legal employment which may lead to negative self-concept and depression. The lack of these roles not only reduces their social status in the community, but may also increase the probability of their joining the illicit drug economy, which is fraught with violence and other stressors. There is limited research on the mechanism by which sexual behavior leads to distress and drug use. However, qualitative data have shown that exchanging sex for money or drugs is a stressful experience.⁴⁰ Also, addiction is often the driving force between an individual's decision to exchange sex.⁵⁶ Thus, there is a continuous cycle between sex risk, addiction, and depression.

In the current cross-sectional study, structural equation modeling (SEM) was used to model the relationship between perceived neighborhood characteristics, depressive symptoms, drug use, and sexual partners (multiple partners, exchanging money or drugs for sex, and injecting and crack smoking partners). As shown in Figure 1, it was hypothesized that perceived neighborhood disorder is linked to both psychological distress and drug use (direct associations). Drug use leads to sexual risk behavior, and psychological distress leads to drug use, which in turn impacted sexual risk behavior (indirect associations).

METHODS

Participants

The data used in this analysis were collected as a part of the SHIELD (Self-Help in Eliminating life Threatening Diseases) project, a network-oriented experimental intervention with a longitudinal cohort spanning five waves of data collection. Targeted outreach in high drug areas was used to recruit participants. Areas of high drug activity were assessed using focus groups, geocoding of drug-related arrests over a 3-year period, and ethnographic observations. During outreach, potential participants were given a description of the study. Interested individuals contacted the research staff to undergo a brief screening to assess eligibility. SHIELD study inclusion criteria consisted of: (1) at least 18 years old, (2) having daily or weekly contact with drug users, (3) willingness to conduct AIDS outreach education, (4) willingness to bring in network members for an interview, and (5) not being enrolled in other HIV prevention or network studies. Eligible individuals were administered consent information and forms followed by a face-to-face interview. The Johns Hopkins School of Public Health Committee on Human Research initially approved the study in March 1997. The data presented here were from the fifth wave of the study, assessed between July 2002 and June 2004. The final sample size was 838 individuals who were part of the longitudinal cohort enrolled in 1997.

Measures

A 7-item, three-point scale that assessed perceptions of neighborhood, based on Perkins and Taylor's Block Environmental Inventory, was administered during the interview.⁵⁷ Participants were asked if the following items were "not a problem", "somewhat of a problem", or a "big problem" on their block: vandalism, litter or trash in the streets, vacant housing, groups of teenagers hanging out on the street, burglary, people selling drugs, and people getting robbed. This measure was found to be associated with observer rating of neighborhood and police crime statistics.^{57, 58} Psychological distress was assessed with the 20-item Centers for Epidemiological Studies Depression Scale (CES-D).⁵⁹ The scale has high validity and reliability.⁶⁰ Perceived neighborhood disorder and psychological distress were operationalized as latent variables. To assess sexual risk behaviors, an ACASI survey asked respondents about sex risk behaviors in the prior 90 days. The following risk behaviors were assessed: number of sex partners, receiving money or drugs in exchange for sex, giving money or drugs to have sex, having sex with someone who used injection drugs, and having sex with someone who used crack cocaine. Participants were also asked if they had used injection drugs or crack cocaine in the previous 6 months.

Data Analysis

Structural equation modeling was used to examine the relationships among neighborhood disorder, participant drug use, psychological distress, and sexual risk behavior. All modeling was conducted in MPlus Version 3.01, which allows SEM with a mixture of observed and latent variables (Muthen & Muthen, Los Angeles, CA, 2004). Model fit was evaluated using the relative chi-square (chi-square fit index divided by degrees of freedom), the Comparative Fit Index (CFI), the Tucker Lewis Index (TLI), and the Root Mean Square Error of Approximation (RMSEA). First, measurement models were constructed for neighborhood disorder, psychological distress, and sex risk, and verified with confirmatory factor analysis. After estimating satisfactory measurement models for both males and females, the hypothesized structural models were tested separately for males and females. A direct association of neighborhood disorder was first estimated without the mediating variable in the model. Next, a model was fitted which included the pathway from neighborhood disorder to psychological distress, and from psychological distress to sex risk. Several sets of models were systematically examined. All analyses were conducted in February 2005.

RESULTS

The sample was 97% African American, 59% male, and 22% HIV positive. In the prior six months, 81% reported that they had been unemployed, 63% on public assistance, 19% had been incarcerated, and 14% homeless. The median age was 43 years and over half (53%) had completed more than 11 years of school. Almost all (97%) had a history of heroin or cocaine use with 27% of the participants reporting recent injection drug use and 36% reporting recent crack cocaine smoking. Table 1 presents data on the perceived neighborhood disorder, depression, and drug and sexual risk behaviors by gender. Among the seven neighborhood perception items, selling drugs was most commonly perceived as a neighborhood problem—almost 20% rated selling drugs as “somewhat of a problem” and 50% rated it a “big problem.”

Only three individuals were excluded from the analysis due to missing data on one or more variables. For the confirmatory factor analysis used to evaluate the measurement model of neighborhood disorder, all seven items loaded on a single factor, and chi-square tests of model fit indicated an adequate model. For psychological distress, 14 items produced non-significant chi-square tests of model fit, which indicated good fit.

Six structural models were tested, for males and for females, by types of drug use (injection drug use, crack use) and types of sexual risk behavior (sex with IDUs or crack user, >1 sex partner, buying/selling sex). The hypothesized full model with direct paths and indirect paths fit the data adequately, for both males and females, as indicated by the Chi-Square Test of Model Fit ($p < 0.05$), the CFI (> 0.95), the TLI (> 0.95) and the RMSEA (< 0.08 , Tables 2 and 3). The one gender difference in the models was that for males buying sex was assessed, whereas for females selling for money or drugs was assessed.

A two-step procedure was used to evaluate the mediation pathway between neighborhood disorder and sexual risk behavior. First, only the direct association of neighborhood disorder was evaluated with no mediating variables in the model. Second, a full model was evaluated, which included pathways from neighborhood disorder to the mediating variables, and from the mediating variables to sexual risk behavior. For females, the direct association of neighborhood disorder on selling sex for money or drugs was significant without the mediating effect of psychological distress or drug use (Table 2: Models 2 & 5), but became statistically insignificant when including the mediating effects, although the size of standardized path coefficient was only slightly reduced. For example, as shown in Figure 2, the direct association of neighborhood disorder on selling sex for money or drugs was significant (path coefficient = 0.17, $p < 0.05$) without the mediating effects. When including mediating variables, neighborhood disorder was associated with higher psychological distress, which in turn was associated with crack use and then selling sex for money or drugs (Figure 2). The indirect pathway, neighborhood disorder → psychological distress → crack use → selling sex for money or drugs, was statistically significant (indirect association = 0.02, $p < 0.05$, Table 2: Model 5). While controlling for indirect associations, the direct association became insignificant (path coefficient = 0.16, $p > 0.05$, Table 2: Model 5, Figure 2), indicating partial mediation.

Similar results were found in males. As shown in Figure 3, the direct association of neighborhood disorder on buying sex was significant (path coefficient = 0.19, $p < 0.05$) without mediating effects. When including mediating effects of psychological distress and crack use, two indirect associations, neighborhood disorder → psychological distress → crack use → buying sex (indirect association = 0.01, $p < 0.05$, Table 3: Model 5) and neighborhood disorder → psychological distress → buying sex (indirect association = 0.07, $p < 0.05$, Table 3: Model 5), were significant. While controlling for indirect associations, the direct association became insignificant (path coefficient = 0.09, $p > 0.05$, Table 3: Model 5, Figure 3).

Among both genders, similar patterns emerged for the models with the risk behavior of having a sexual partner who smoked crack or injected (Tables 2 & 3; models 1 & 4). Among all the models there was a significant pathway between neighborhood disorder and distress (Tables 2 & 3). For 11 of 12 models there was a significant relationship between distress and crack or injection drug use (Tables 2 & 3). The majority of the indirect pathways from neighborhood characteristics to distress to substance abuse to sex risk were significant (Tables 2 & 3). Among males, 4 of the pathways of drug use to sex risk were significant (Table 3) and among females in all 6 models drug use was associated with sexual risk (Table 2).

DISCUSSION

The results of this cross-sectional study partially confirm the study hypotheses and suggest that there are both direct and indirect pathways from perceived neighborhood disorder to sexual risk behaviors that are linked to HIV and other STIs, among a sample of current and former inner-city drug users. The SEM models indicated a pattern of neighborhood disorder leading to psychological distress, then to drug use and from drug use to sexual risk behaviors. There were also significant direct associations of neighborhood disorder on sexual risk behaviors. These results suggest that neighborhood disorder represents a salient set of stressors. These environmental stressors are linked both to depressive symptoms and to drug use. The measure of neighborhood disorder used in this study is likely a marker for other physical and social stressors including violence, the lack of opportunities and prosocial roles, and economic and psychological entrapment.

As discussed in the introduction, disadvantaged neighborhoods can be a source of stress proliferation due to many problems. The observed relationship between drug use and sexual risk behavior also may be explained in part by the economic pressures to exchange money or drugs for sex, assortative mating, and structured opportunities such as crack houses and shooting galleries where high risk partners interact.

These study findings are limited by self-report data, cross-sectional study design, and non-random sample. Although a range of SEM models were tested, it is likely that the models presented do not fully account for reciprocal relationships among the behaviors nor do they assess all stressors and potential mediating variables. Prospective studies to assess causal pathways are needed as are ethnographic observations of neighborhoods to delineate the dynamics of the stress process and stress proliferation. The findings may not be generalized to other urban areas with different patterns of neighborhood mobility, density, and dilapidating houses. However, similar patterns of drug use and violence are found in many urban areas.
40, 61

The social inequities of U.S. urban areas are demonstrated by the high rates of drug use and incarceration, and the lack of opportunities for adequate employment and lower risk partners. Even within inner-city environments the results of this study suggest that there are marked differences in perceived neighborhood disorder that may have a significant effect on well-being and infectious disease transmission. It has been clearly demonstrated that removing children from high risk environments leads to beneficial outcomes.⁶² It is highly likely that adults would also benefit from such residential changes. Clearly, greater access to drug treatment is imperative in such communities, but it is unlikely that individual-focused approaches to substance abuse, HIV and HCV prevention will be sufficient. Future research and interventions should focus on community programs such as reestablishing social norms that discourage violence and drug use, improving police relationships with communities, enhancing the employability of residents, developing alternative economic activities to the drug economy, providing prosocial opportunities such as employment and valued roles in social organizations, and fostering urban renewal to reduce the physical decay.

Acknowledgements

This work was funded by the National Institute on Drug Abuse, grant# R01DA016555.

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Figure 1.

Hypothesized structural model for males and females

Neighborhood disorder has direct associations with psychological distress (4), drug use (5), and sex risk behaviors (1)

Neighborhood disorder has an indirect association with sex risk behavior operating through psychological distress and drug use (4 to 6 to 3)

Psychological distress has a direct association with sex risk behaviors (2)

Drug use has a direct association with sex risk behaviors (3)

Figure 2.

Model 5, structural equation modeling for females

Bolded coefficients significant at $p < 0.05$

Coefficients are standardized

Coefficient in () represents the direct association with neighborhood disorder

Indicators for psychological distress and neighborhood disorder not pictured: 14 indicators for psychological distress, seven indicators for neighborhood disorder

Figure 3.

Model 5, structural equation modeling for males

Bolded coefficients significant at $p < 0.05$

Coefficients are standardized

Coefficient in () represents the direct effect of Neighborhood Disorder

Indicators for psychological distress and neighborhood disorder not pictured: 14 indicators for psychological distress, seven indicators for neighborhood disorder

Table 1

Risk behavior descriptive statistics

RISK BEHAVIOR	Males <i>n</i> =494		Females <i>n</i> =344	
	<i>n</i>	(%)	<i>n</i>	(%)
Sex with IDU past 90 days	80	(16.19)	44	(12.79)
Exchange money or drugs for sex past 90 days	82	(16.60)	46	(13.37)
>1 sex partner past 90 days	125	(25.30)	64	(18.60)
Sex with crack user past 90 days	150	(30.36)	84	(24.42)
Injection drug use past 30 days	149	(30.16)	73	(21.22)
Crack use past 6 months	159	(32.19)	141	(40.99)

IDU, IV drug user

Table 2

Structural models for females

Path ^{a,b}	Model number					
	1	2	3	4	5	6
1. Neighborhood disorder→sex risk beh (direct association only)	(-0.01)	(0.17)	(0.14)	(0.02)	(0.17)	(0.14)
2. Psych distress→sex risk beh	-0.04	0.15	0.10	0.03	0.16	0.13
3. Drug use→sex risk beh	0.06	0.02	0.11	0.01	0.08	0.10
4. Neighborhood Disorder→psych distress	0.49	0.55	0.26	0.51	0.41	0.42
5. Neighborhood disorder→drug use	-0.03	-0.03	-0.03	-0.07	-0.07	-0.07
6. Psych distress→drug use	0.24	0.24	0.24	0.17	0.17	0.17
Tests for indirect associations						
Neighborhood disorder→psych distress→drug use→sex risk beh	0.03	0.03	0.01	0.02	0.02	0.02
Neighborhood disorder→psych distress→sex risk beh	0.01	0.00	0.03	0.00	0.02	0.02
Neighborhood disorder→drug use→sex risk beh	-0.01	-0.02	-0.01	-0.03	-0.03	-0.03
Model fit statistics						
Chi-square	148.87	144.38	148.05	157.29	146.59	148.04
Degrees of freedom	66	65	66	66	66	66
Relative chi-square	2.26	2.22	2.24	2.38	2.22	2.24
CFI	0.97	0.97	0.97	0.96	0.97	0.97
TLI	0.98	0.98	0.98	0.98	0.98	0.98
RMSEA	0.06	0.06	0.06	0.06	0.06	0.06

Model 1: Drug Use is Injection Drug Use Past 30 Days, Sex Risk Behavior is Sex with IDU Past 90 days

Model 2: Drug Use is Injection Drug Use Past 30 Days, Sex Risk Behavior is Selling Sex for Money or Drugs Past 90 days

Model 3: Drug Use is Injection Drug Use Past 30 Days, Sex Risk Behavior is More Than 1 Partner Past 90 days

Model 4: Drug Use is Crack Use Past 6 Months, Sex Risk Behavior is Sex with Crack User Past 90 days

Model 5: Drug Use is Crack Use Past 6 Months, Sex Risk Behavior is Selling Sex for Money or Drugs Past 90 days

Model 6: Drug Use is Crack Use Past 6 Months, Sex Risk Behavior is More Than 1 Partner Past 90 days

^aCoefficient in parentheses is direct association of Neighborhood Perceptions of Disorder Only

^bCoefficients in bold are significant at $p<0.05$; all coefficients are standardized

CFI, Comparative Fit Index; TLI, Tucker Lewis Index; RMSEA, root mean square error of approximation

Table 3

Structural models for males

Path ^{a,b}	Model number					
	1	2	3	4	5	6
1. Neighborhood disorder→sex risk beh (direct association only)	(0.14) 0.09	(0.19) 0.11	(0.08) 0.05	(0.19) 0.09	(0.19) 0.09	(0.08) 0.04
2. Psych distress→sex risk beh	0.18	0.26	0.08	0.06	0.19	0.02
3. Drug use→sex risk beh	0.24	-0.11	-0.12	0.41	0.21	0.16
4. Neighborhood disorder→psych distress	0.33	0.33	0.33	0.34	0.33	0.33
5. Neighborhood disorder→drug use	-0.09	-0.09	-0.09	0.13	0.13	0.13
6. Psych distress→drug use	0.22	0.22	0.22	0.20	0.20	0.02
Tests for indirect associations						
Neighborhood disorder→psych distress→drug use→sex risk beh	0.02	0.00	-0.01	0.03	0.01	0.01
Neighborhood disorder→psych distress→sex risk beh	0.06	0.09	0.03	0.02	0.07	0.01
Neighborhood disorder→drug use→sex risk beh	-0.02	0.01	0.01	0.05	0.03	0.02
Model fit statistics						
Chi-square	190.29	191.68	189.47	190.22	186.98	184.79
Degrees of freedom	75	75	75	75	75	75
Relative chi-square	2.54	2.56	2.53	2.54	2.49	2.46
CFI	0.97	0.97	0.97	0.97	0.97	0.97
TLI	0.99	0.99	0.99	0.99	0.99	0.99
RMSEA	0.06	0.06	0.06	0.06	0.05	0.05

Model 1: Drug Use is Injection Drug Use Past 30 Days, Sex Risk Behavior is Sex with IDU Past 90 days

Model 2: Drug Use is Injection Drug Use Past 30 Days, Sex Risk Behavior is Buying Sex with Money or Drugs Past 90 days

Model 3: Drug Use is Injection Drug Use Past 30 Days, Sex Risk Behavior is More Than 1 Partner Past 90 days

Model 4: Drug Use is Crack Use Past 6 Months, Sex Risk Behavior is Sex with Crack User Past 90 days

Model 5: Drug Use is Crack Use Past 6 Months, Sex Risk Behavior is Buying Sex with Money or Drugs Past 90 days

Model 6: Drug Use is Crack Use Past 6 Months, Sex Risk Behavior is More Than 1 Partner Past 90 days

^aCoefficient in Parentheses is direct association of Neighborhood Perceptions of Disorder Only^bCoefficients in Bold are significant at $p < 0.05$, all coefficients are standardized

CFI, Comparative Fit Index; TLI, Tucker Lewis Index; RMSEA, root mean square error of approximation