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Neighborhood Ecology and Drug Dependence Mortality: An Analysis of New York City Census Tracts

Lance Hannon, Ph.D.[1] and Monica M. Cuddy, M.A.[2]
[1]Sociology Department, Villanova University, Villanova, Pennsylvania, USA
[2]National Board of Medical Examiners, Philadelphia, Pennsylvania, USA

Abstract: Drug dependence mortality appears to be highly concentrated in certain disadvantaged populations and in certain disadvantaged areas. Using a relatively large sample of census tract data for New York City, 1991–1995 (N = 2,037), the present study examines the structural covariates of drug dependence mortality rates. Spatially lagged negative binomial regression analyses indicated considerable support for previous findings regarding the importance of poverty as a predictor of drug mortality. Furthermore, two variables especially relevant for the social disorganization and deviant opportunity perspectives in criminology exhibited significant independent effects: the neighborhood home-ownership rate and the prevalence of boarded-up housing. The results support various policy initiatives concerned with the relationship between neighborhood environment and public health.

Keywords: Drug-related mortality, poverty, social disorganization

INTRODUCTION

Economic deprivation is clearly an important correlate of premature mortality. The most intuitive way to understand the role of economic deprivation in health outcomes is to consider the detrimental physical and psychological consequences for the individual living in poverty. However, there is a growing body of epidemiological theory and research that takes a more macro perspective, focusing on group dynamics and collective neighborhood resources (1). Thus, there is empirical evidence

Address correspondence to Lance Hannon, Sociology Department, Villanova University, Villanova, PA 19085, USA. E-mail: lhannon@oxy.edu

documenting the relationship between poverty and mortality at both the individual and community levels of analysis (2, 3).

Ecological research on mortality at the neighborhood level has borrowed heavily from a robust literature in criminology on community resources/disadvantages and the incidence of crime. Therefore, not surprisingly, many neighborhood level studies examine the relationship between environmental conditions and violent death rates (4, 5). Interestingly, however, there are relatively few neighborhood studies on a related problem, namely, death from substance abuse (6).

Hoping to add to this literature, the present study adopts an ecological approach to the study of drug dependence mortality and makes use of a relatively large sample of neighborhood data for New York City. The study's primary goal is to establish whether measures of community stability and deteriorated housing have independent effects on drug death rates after controlling for important known correlates such as poverty. The analysis is informed by insights from two theories in macro criminology: the social disorganization and deviant opportunity perspectives.

SOCIAL DISORGANIZATION

The social disorganization perspective in macro criminology originated with Shaw and McKay's seminal research on Chicago neighborhoods in the early 1900s (7). Shaw and McKay argued that neighborhood poverty and residential instability lead to weak social bonds among community members. In socially disorganized areas, residents find it difficult to collectively mobilize to achieve universally beneficial goals, such as establishing a clean and safe community. According to the social disorganization perspective, poverty understandably creates a preoccupation with meeting individual basic needs, often eclipsing moral sentiments about helping neighbors or reprimanding them for unhealthy behavior. High population turnover and low levels of homeownership may similarly translate into a lack of investment in a community's collective welfare, since residents may not perceive permanency in their living arrangements and may not develop strong social ties with neighbors.

Extending and clarifying Shaw and McKay's classic work, some recent research outlines two primary types of ecological effects associated with social disorganization: those that discourage conformist community members from caring about the misbehaviors of others, and those that encourage nonconformists to engage in unhealthy behavior. Both types of ecological effects may play important roles in determining drug abuse and drug dependence mortality in a community. Consistent with Shaw and McKay's original theory, the first type of ecological effect has been

described as a product of "collective efficacy" (8). When community members have strong social networks and recognize their collective ability to make positive neighborhood changes, the resulting enhanced social control and social support decrease the likelihood of problems such as drug dependence mortality.

The second related type of ecological effect associated with social disorganization has been described as the "broken windows" phenomenon (9). In essence, this viewpoint argues that the physical disorder of a neighborhood contributes to unhealthy behavior by sending cues about the ease to which such behavior can be accomplished without repercussions. Consistent with this type of ecological effect, graffiti, litter, and deteriorating housing can motivate nonconformists by sending the message that they can get away with illicit and unhealthy behaviors such as the sale and use of illegal drugs (10).

DEVIANT OPPORTUNITY

The deviant opportunity perspective focuses on the ways in which environmental characteristics facilitate negative health behavior by providing physical opportunities for people to engage in detrimental health activities (11). This perspective suggests that urban blight does more than provide nonconformists with cues about the level of community disorganization. It also provides the physical space nonconformists need to engage in certain negative health behaviors. In terms of drug abuse, this perspective predicts that neighborhoods with easily accessible vacant houses will have high drug mortality rates because such areas provide the physical conditions that enable and intensify drug dependence (12).

Despite the popular association between vacant houses and illicit drug markets, few scientific studies have explicitly investigated the relationship between abandoned residential buildings and substance abuse. Using a matched cohort design that controlled for poverty (and other potentially confounding factors), one study examined the effect of abandoned housing on drug-related calls to the police in Austin, Texas (12). The findings from this criminological study suggested that drug-related crimes are generally more frequent in neighborhood blocks with abandoned housing compared with neighborhood blocks without such housing. Consistent with the "defensible space" perspective of crime control (11), this study suggested that identifying and eliminating opportunities for drug trade in vacant houses may be a viable strategy for alleviating the problem. While such a strategy will undoubtedly lead to some displacement, where dealers and users simply move to areas with greater deviant opportunity, it is likely that many would-be users and

dealers will lack the initiative to venture into unfamiliar territory. Moreover, properly securing or demolishing abandoned housing is relatively inexpensive (12), and thus may be one of the few realistic policy options for communities lacking economic capital.

DATA, VARIABLES, AND METHODS

The data for the present analyses are for New York City census tracts. As the largest city in the U.S., with a population of about 8,000,000, New York has over 2,000 census tracts and has remarkable variation in the key variables used in the present inquiry: drug death incidence, the prevalence of boarded-up housing, homeownership rates, poverty rates, racial composition, and other demographic measures. While census tracts are not true neighborhoods, they are designed to be relatively homogenous units by census officials who take into account socially meaningful boundaries when defining areas (such as major streets). Several studies have argued that census tracts are excellent proxies for neighborhoods, since they are small enough to capture within-city variation in the phenomenon being studied, yet large enough to help ensure reliable calculation of demographic variables (4, 13, 14).

The drug death data for the current study are derived from the records of the New York City Department of Health and were geocoded to census tracts based on the street address of the deceased. These data were made available through the Infoshare organization (15). Data for the years 1991–1995 were selected to roughly correspond with demographic measures from the 1990 Census (more recent mortality data were not available). Counts of deaths from *drug dependence* (ICD-9 code 304) were summed for the 5 years to help minimize the impact of random yearly fluctuations. The present study focuses on deaths classified as resulting from drug dependence to parallel some previous research in this area, and because recent reports from New York City's Department of Health suggest that New York City examiner coding conventions place the vast majority (97%) of drug abuse deaths in this single category (16).

Using a boundary file distributed by the US Census Bureau in their special release, *Poverty Areas in the United States, SSTF 17*, a total of 2,194 census tracts were found to be clearly within city limits (17). Of these tracts, 118 were dropped from the sample because they had populations less than 500 and appeared to be nonresidential areas. In addition, 39 tracts had missing data on drug death cases for the various years and were thus excluded from the sample. The 2,037 remaining tracts constitute a relatively large sample for the investigation of the structural covariates of drug dependence mortality.

Poverty was operationalized using a standardized index summing four highly correlated variables: the official poverty rate, median family income (reverse coded), the percentage of households receiving public assistance income, and the unemployment rate. All of these variables were derived from data from the US Census Bureau (17) and all were equally weighted in the resulting poverty index (alpha = .94). Consistent with several studies testing the social disorganization hypothesis that community stability can reduce rates of social pathology, the percentage of residences owner-occupied was used as an indicator of the presence of long-term, vested community members (18, 19) Also consistent with some recent research on general mortality, the percentage of houses vacant and boarded-up (square-root transformed to reduce skew) was used to assess the deviant opportunity provided by such housing conditions (20). Other variables derived from decennial census sources included the percentage of the population foreign born, the percentage of the population between the ages of 25 and 34, the ratio of males to females, the percentage of the population black, and the percentage of the population of Hispanic origin. These control variables were chosen based on past theory and research on the structural covariates of drug death rates (21–25) as well as a desire to maintain appropriate levels of multicollinearity. None of the independent variables were correlated above .65.

Because death from drug dependence is a relatively rare event, neighborhood rates are often excessively positively skewed. This substantially increases the likelihood of two important estimation problems for the traditional least squares regression framework: nonconstant error variance and influential outliers. Poisson-based regression provides a useful solution to such problems, since the underlying model does not assume a normal or even symmetrical distribution of errors and outlying observations for the dependent variable are brought closer to the rest of the data with an implicit log transformation (one that does not require adding an arbitrary constant to zero values) (26). Poisson regressions are commonly used to estimate effects for counts of rare events, but they can also be adapted to measure event rates for a local population. The present study uses a variant of traditional Poisson regression to estimate the structural covariates of drug dependence death rates: the negative binomial model with a residential population offset.

Another potential obstacle for the estimation of the covariates of drug-related mortality at the neighborhood level is spatial autocorrelation (27). Spatial autocorrelation, specifically positive spatial autocorrelation, refers to the geographic clustering of neighborhoods by levels of the dependent variable. Although often ignored in ecological research, this phenomenon is pervasive and likely important for the efficiency and accuracy of parameter estimates. Models that do not account for

spatial autocorrelation implicitly assume that a high mortality neighborhood is as likely to be adjacent to a low mortality neighborhood as another high mortality one. This assumption is clearly problematic, particularly in terms of the possibility of diffusion where events in one area could easily affect the level of disorganization and mortality in nearby areas. Not surprisingly, a global Moran's I test for spatial autocorrelation in New York City tract drug death rates revealed high levels of positive spatial autocorrelation. In order to model this spatial dependence, a spatial lag variable was included in the negative binomial regression as a control. The spatial lag was calculated using a 2-stage least squares approach, and can be conceptualized as representing the average drug death rate for an observation's 5 nearest neighbors (based on distance matrices for population centroids) (27).

RESULTS

Table 1 presents the means and standard deviations for various measures relevant to this study. The average population size for a census tract was 3,506 and the average distance between the population center of a tract and the population center of its closest neighbor was approximately one quarter of a mile. Drug dependence mortality was a rare event for these small areas, with a mean count of less than 2 in a 5-year period. Still, there was tremendous variation among tracts in drug dependence deaths; many tracts had no deaths, while others had several times the average.

Table 2 summarizes the results of the cross-sectional negative binomial regression analysis of the variation in drug dependence mortality across tracts. An offset variable defined by the log of the population

Table 1. Means and standard deviations (N = 2,037 NYC tracts)

Variable	Mean	SD
Population size	3,506	2,367
Distance to center of closest tract (miles)	.235	.167
# of drug deaths (1991–1995)	1.84	2.46
Poverty index	0	.93
% Boarded-up housing (square root)	.40	.42
% Homeowners	34.48	24.97
% Ages 25–34	18.25	4.31
Ratio of males to females	.90	.15
% Foreign born	34.04	15.43
% Black	28.99	34.10
% Hispanic origin	22.59	21.91

Table 2. Negative binomial regression results for drug dependence mortality

Variable	Coefficient	SE
Poverty index	.196***	.036
% Boarded-up housing (square root)	.169***	.048
% Homeowners	−.007***	.001
% Ages 25–34	.022***	.006
Ratio of males to females	.489**	.158
% Foreign born	−.017***	.002
% Black	.005***	.001
% Hispanic origin	.009***	.002
Spatial lag	.092**	.032
Constant	−7.522***	.340
Dispersion parameter	.119	
Pseudo R^2	.330	
N	2,037	

**P < .01.
***P < .001.

size was used to transform the negative binomial model from an analysis of counts to an analysis of rates. The model also included a parameter to account for overdispersion and a spatial lag to account for significant positive spatial autocorrelation.

In terms of coefficient sign and statistical significance, all of the covariates displayed their expected relationship with drug dependence mortality rates. Consistent with earlier ecological research on drug-related death rates, the poverty index was strongly positively associated with drug dependence mortality (6). Also consistent with previous findings, drug dependence mortality rates were higher in areas with more males, a greater proportion of the population between the ages of 25 and 34, a higher percent Black, and a higher percent of Hispanic origin (22–24). The percent foreign born displayed a negative association with drug dependence mortality, as suggested by the general "healthy migrant thesis" in demography (21). While the direction of the effect was congruent with the hypothesis that motivated its inclusion in the model, the magnitude of the effect was larger than expected. Using the standard interpretation of negative binomial coefficients (a unit change in x changes the dependent variable by $100(e^b - 1)$ percent), the coefficient suggests that a 1% increase in the percent foreign born would decrease the drug death rate by 1.69%.

In regard to the two variables central to the social disorganization and deviant opportunity perspectives, the homeownership rate and the prevalence of boarded-up houses, the results were consistent with expectations. The homeownership rate displayed a moderate negative

relationship with drug dependence mortality, and the prevalence of boarded-up houses displayed a moderate positive relationship. Importantly, both of these relationships were independent of the degree of poverty in an area. In line with social disorganization theory, low levels of homeownership in poor neighborhoods appear to exacerbate already high drug death rates. Similarly, consistent with the deviant opportunity perspective, a high prevalence of boarded-up houses in poor neighborhoods appears to make matters significantly worse.

In a supplemental analysis, the model was estimated for a sample of New York City tracts with poverty rates 40% and greater (N = 227). The 40% mark was chosen because it is typically cited in neighborhood research as indicative of "extreme poverty" (13, 14). Even in this truncated sample of extremely disadvantaged areas, both the homeownership rate and the prevalence of boarded-up housing displayed their expected relationships with variation in drug dependence mortality. In another alternative analysis, the basic model was estimated using a drug abuse mortality variable that followed an operationalization in a recent report from the New York Department of Health (28). This measure of drug-related mortality included both deaths classified as *drug dependence* (ICD-9: 304) and those classified as *accidental drug poisoning* (ICD-9: E850.0, E854.1, E855.2, and E858.8). The central findings were unchanged using this alternative dependent variable.

DISCUSSION AND CONCLUSION

Examining the structural covariates of drug dependence mortality, this ecological study draws from two important theories in sociological criminology: the social disorganization and the deviant opportunity perspectives. The social disorganization perspective suggests that low levels of community stability translate into low levels of social control and social support. This in turn increases the likelihood of drug abuse and drug dependence mortality. The deviant opportunity perspective suggests that communities with certain land use and housing characteristics provide the physical conditions that enable and intensify drug dependence. The findings from the present study offer support for both of these perspectives. In particular, controlling for several important factors (such as poverty), the homeownership rate and the prevalence of vacant boarded-up houses had independent effects on neighborhood drug dependence mortality rates.

Because the definition of drug dependence mortality used in this study encompasses a wide range of deaths from substance abuse, it is possible that the analyses may have obscured differences in the correlates of mortality for particular types of drug dependence (e.g., deaths associated

with cocaine addiction versus heroin addiction). Future research should consider disaggregating the drug dependence mortality measure to investigate this possibility. Furthermore, there may also be some important aggregation issues deserving attention in the use of the percent foreign born. Considering the pronounced negative relationship between this measure and drug dependence mortality rates, future research should examine the importance of specific country of origin in determining the strength of the effect. It might also prove useful to identify the currently unmeasured intervening variables that account for the independent effects of the percent Black and percent Hispanic on drug dependence mortality (e.g., segregation). Finally, as nested data become more readily available, future research should also try to utilize multilevel designs that can disentangle individual and ecological effects.

The present study provides general support for two policy initiatives especially relevant for the reduction of negative health behaviors in economically disadvantaged areas: policies aiming to increase homeownership and policies seeking to eliminate abandoned buildings (29, 30). The implementation of these policies may significantly reduce levels of drug dependence and drug dependence mortality. Policies geared toward increasing homeownership in economically disadvantaged areas may contribute to decreases in drug dependence by encouraging community pride and decreasing levels of neighborhood social disorganization. Such policies are also supported by evidence from several recent studies documenting the benefits of homeownership in terms of various individual, household, and neighborhood health outcomes (31). Policies seeking to reduce the number of abandoned properties in economically disadvantaged communities may lessen drug dependence and drug dependence mortality by removing the physical space that facilitates many drug activities. The potential benefits of such land use policies are further bolstered by findings from some recent research on the relationship between neighborhood housing conditions and rates of sexually transmitted disease (10, 20).

Overall, the results of the present study underscore the need for continued research and policy attention to the impact of neighborhood environment on substance abuse and drug-related mortality. While most policies addressing drug dependence focus exclusively on the rehabilitation of the individual, the revitalization and rebuilding of neighborhoods may also be a worthwhile approach.

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