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# Environmental Conditions, Political Economy, and Rates of Injection Drug Use in Large US Metropolitan Areas 1992 – 2002

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## Abstract

City-specific studies have suggested the quality of the local environment and economic circumstances are associated with greater risk of injection drug use (IDU). No studies have assessed the relation among the quality of the local environment, economic circumstances, and IDU over time across US metropolitan areas. Annual numbers of IDUs in the 88 largest US metropolitan statistical areas (MSAs) were estimated by extrapolating, adjusting, and allocating existing estimates using various data sources. Generalized estimating equations were used to assess the relation among the quality of the local environment, metropolitan political economy, and IDU prevalence using lagged models taking into account potential confounders. MSAs with a worse local environment (measured as a one standard deviation difference) had a greater risk of IDU (relative risk [RR] = 1.03, 95% confidence interval [CI]: 1.01, 1.06); similarly, a one-percentage point worsening of the political economy for an MSA was associated with greater risk of IDU (RR=1.04 to 1.10). Final models stratified by region indicated heterogeneity of effect by region whereby the quality of the local environment was associated with IDU strongest in the South (RR=1.12, CI: 1.05, 1.12) followed by the West (RR=1.04, CI: 1.01, 1.07) and Midwest (RR=1.03, CI: 1.00, 1.06), and the metropolitan political economy was associated with IDU in the West (RR=1.03 to 1.09) and Northeast (RR=1.04 to 1.12). Our results underscore the importance of sociopolitical factors as determinants of IDU in MSAs. Structural solutions targeted at improving environmental conditions and economic circumstances should be considered as drug use interventions.

### Keywords

Injection Drug Use; Environmental Conditions; Political Economy; Metropolitan Statistical Areas

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## 1.0 Introduction

Drug users, particularly injection drug users (IDUs), experience higher morbidity and mortality than the general population (Contoreggi et al., 1998; Cooper et al., 2007a). For example, the Centers for Disease and Control Prevention, (2002 Disease and Control Prevention, (2005) reports that in the year 2000 60% of new cases of Hepatitis C occurred in IDUs and that in 2003 IDUs accounted for 22% of new AIDS cases while comprising less than 1% of the U.S. population (Brady et al., 2008; U. S. Census Bureau, 2007). It is also known that injection drug use (IDU) is disproportionately concentrated among socially and economically marginalized populations (Centers for Disease and Control Prevention, 2005; Galea and Vlahov, 2002; Spittal and Schechter, 2001). Further, IDU incurs substantial economic costs (Palepu et al., 2001). Therefore, understanding the etiology of IDU is of paramount importance.

Research on the determinants of drug use (including IDU) has typically focused on identifying the characteristics of individuals that make them more likely to use drugs. These individual-level determinants include but are not limited to: socioeconomic status (SES), genetic predisposition, social support and social networks, the co-occurrence of psychiatric disorders and exposure to life stress, and psychological distress (Fuller et al., 2001; Latkin et al., 1995; Roy et al., 2003). While these insights are important, this body of research focuses on the individual-determinants of risk behavior and not the causes of incidence (Rose, 2001). As articulated by Rose (2001), and applied to drug use by Friedman (2002), we are interested in social structures as determinants of population mean levels of IDU. Reducing drug risk behavior will likely require structural solutions targeted at multiple dimensions of the environment (Des Jarlais, 2000; Rhodes et al., 2005).

Recently, several reviews have outlined how aspects of the social, cultural, economic, political and physical environments may be important determinants of drug use and its consequences (Burris et al., 2004; Friedman, 2002; Friedman et al.; Galea et al., 2004; Galea et al., 2005b; Rhodes, 2002; Rhodes et al., 2005). Building on this previous work we were particularly interested in investigating how two features of the urban environment may jointly and independently influence drug use: the quality of the local environment and aspects of the metropolitan political economy, as well as their variation across time and place. Our interest in these constructs is rooted in epidemiology's recent interest in how the characteristics of places may influence population health (Diez-Roux, 1998; Susser and Susser, 1996). Some have pointed out the centrality of social structures in the production of population health and have argued they merit particular attention (Krieger, 1994; Link and Phelan, 1995).

### 1.1 Previous Studies

Previous intra-urban analyses have investigated the relations between the quality of the local environment, measures of political economy and drug use or its consequences. For example, Duncan et al. (2002) used multilevel models to demonstrate an association between perceived neighborhood problems with youth alcohol and drug use as well as youth alcohol and drug arrests in a metropolitan city in the Pacific Northwest. Boardman et al. (2001) found an association between the percent living below the poverty line, percent of female headed households, male unemployment and percent of families receiving public assistance, and drug use in Detroit census tracts after accounting for relevant individual level covariates. Other work in Baltimore (Crum et al., 1996; Fuller et al., 2005; Latkin and Curry, 2003; Latkin et al., 2005), Houston (Bell et al., 1998), Jersey City (Weisburd and Mazerolle, 2000), New York City (Galea et al., 2003; Hembree et al., 2005), and San Francisco (Davidson et al., 2003) report associations between social and economic circumstances with a range of outcomes including IDU, cocaine use, drug use and drug overdose.

Studies that have used national samples have also found comparable results. For example, Jang and Johnson (2001), using data from the National Youth Survey, and Winstanley et al. (2008), using data from the National Survey on Drug Use and Health, found that living in a neighborhood characterized by social and physical disorder (e.g. crime, drug selling, abandoned buildings etc) was associated with self reported adolescent substance (ab)use.

### 1.2 Theoretical Framework

The quality of the local environment has been operationalized in several ways (Bell et al., 1998; Li et al., 1999; Sampson et al., 1997; Winstanley et al., 2008). Examples include perceptions of vandalism, litter, vacant housing, groups of teens hanging out, burglary, selling drugs, and public robbery in the neighborhood (Latkin and Curry, 2003), presence of drug dealing, shootings, murders and abandoned buildings, whether neighbors are on welfare, and whether there are homeless people and/or prostitutes in the neighborhood (Hadley-Ives et al., 2000). The quality of the local environment may be related to drug use through (a) the creation of physical locations to process, buy/sell and use drugs (e.g. abandoned buildings) (Galea et al., 2005a) (b) psychological distress in response to noxious stimuli (e.g. violence) (Galea et al., 2005a; Taylor et al., 1997; Wilson and Kelling, 1982) (c) the adoption of deleterious health behaviors (e.g. IDU) as a coping mechanism in response to structural violence (Bourgois et al., 2004; Cockerham, 2005; Fullilove, 1993; Lillie-Blanton et al., 1993) and/or (d) the concentration (or lack of) goods and services in relation to local and national political hierarchies (Galea et al., 2005a; Takahashi, 1997; Tempalski et al., 2007b).

We use the term political economy to refer to the conditions under which economic production is organized and metropolitan political economy to refer specifically to a set of economic circumstances at the metropolitan level that are closely tied to political decisions. These decisions are made at multiple levels (city, county, state, and federal) with consequences for health (Schoeni et al., 2008). Aspects of the metropolitan political economy might be related to prevalence of drug use by (a) increasing the number of stressful life events residents experience, (b) heightening psychological distress among residents and (c) decreasing residents access to salubrious health and social services as several case studies have documented (Bell et al., 1998; Bourgois, 2003a; Freudenberg et al., 2006; Waitzkin, 2007; Wallace, 1990). Economic disenfranchisement represents a powerful form of structural violence constraining an individual's ability to make healthy life choices (Bourgois, 2003b; Cockerham, 2005) while simultaneously reducing access to resources designed to mitigate the effects of such choices.

Regions of the U.S. differ politically and socially. These differences are the result of many factors including historical trends and ideological leanings. Regional political and cultural heterogeneity may influence IDU prevalence through (a) differential provisions of services (Tempalski et al., 2007a) (b) differential trends in drug tastes (Substance Abuse Mental Health Services Administration, 2007) or (c) differential structural hierarchies of power related to place (Cooper et al., 2005; Cooper et al., 2007b). Regional variation in metropolitan statistical area (MSA) IDU prevalence has been described in relation to various racial/ethnic differences (Cooper et al., 2005; Cooper et al., 2007b) and regional differences in injection behavior have been linked to the distribution of different types of heroin (Ciccarone and Bourgois, 2003).

Other community-level constructs may also play an important role in influencing the relation between the quality of the local environment, political economy, region of the country and drug use: policing and population size. The U.S. relies on law enforcement to reduce drug use through interdiction of illegal substances to decrease supply and demand (Friedman, 2002; The White House, 2008). The merits and effects of this policy orientation are the subject of debate. We include measures of police presence to control for any such effect of interdiction. We also control for population size to account for potential differences between burgeoning

metropolises and smaller metropolitan areas. For example, large metropolitan areas may, ceteris paribus, be better able to support drug-dealing networks.

### 1.3 Study Aims and Hypothesis

Our previous work at the metropolitan level has investigated the relation between several aspects of the social environment and IDU, including over-the-counter syringe sale laws (Friedman et al., 2001), political economy (Friedman et al., 2000), racial/ethnic disparities and racial residential segregation (Cooper et al., 2005; Cooper et al., 2007b), law enforcement (Friedman et al., 2006), drug treatment coverage (Friedman et al., 2007b), and syringe exchange programs (Tempalski et al., 2008; Tempalski et al., 2007a; Tempalski et al., 2007b). However, we are aware of no work that has assessed the relation between the quality of the local environment (together with multiple dimensions of the metropolitan political economy) and IDU in a large sample of MSAs or examined this relation using longitudinal data. We aimed to identify and disentangle the relations between the quality of the local environment and aspects of the metropolitan political economy as potential determinants of IDU prevalence in large US metropolitan areas. Based on the extant literature we hypothesized that MSAs with a decreased quality of the local environment, and poor prevailing economic circumstances would have higher IDU prevalence after taking into account other potentially important factors.

## 2.0 Data and Methods

### 2.1 Unit of Analysis

The unit of analysis for this study was the MSA as defined by the Office of Management and Budget (Office of Management Budget, 2000). MSAs consist of a central city with a population of 50,000 or greater and include all adjacent counties with a high level of social and economic integration with the central city as defined by commuting patterns. Our study population was the 96 largest US MSAs in 1993 (based on 1993 population estimates) minus eight MSAs excluded for missing values. The boundary definitions of MSAs used in this analysis did not change substantively over the time period.

There are many different levels of influence that contribute to the production of population health including IDU prevalence (Kaplan et al., 2000; Osypuk and Galea, 2007). Here, we are concerned with the MSA as it enables us to (a) test hypotheses generated from intra-urban studies across many urban locations (generalizability) (b) provides a complementary unit of analysis to previously conducted analyses (which level/levels of influence) and (c) assess determinants of regional heterogeneity in IDU. Additionally, the MSA is of intrinsic interest to drug use research as many injectors live in the suburbs but buy drugs and perhaps receive drug-related services in the central city (Thorpe et al., 2001). Furthermore, the economic, social and cultural homogeneity inherent in an MSA makes it a reasonable unit of analysis in which to study drug use.

### 2.2 Dependent Variables

Our dependent variable was estimates of the number of IDUs in each of 96 large MSAs in each year between 1992–2002; these estimates have been published previously (Brady et al., 2008). Briefly, annual numbers of IDUs in the 96 largest US MSAs were imputed by 1) calculating the number of injectors living in the US during each year of the study period using existing estimates of the number of injectors living in the US in 1992 and 1998, 2) adjusting these estimates to account for injectors' encounters with health services and the criminal justice system in the US during each year of the study period, 3) allocating these national IDUs population totals to each of the 96 MSAs using (a) an estimate derived from published estimates

of the number of injectors living in each MSA in 1992 and in 1998, and (b) data on injectors' service use and AIDS diagnoses.

### 2.3 Independent variables

Building on past work we operationalized the quality of the local environment as a subset of variables characterizing MSA neighborhoods collected via the American Housing Survey (AHS) from 1992 – 2002 (U.S. Department of Commerce, 2005). The following four variables were included: (a) whether crime in the neighborhood was bothersome, and (b) whether abandoned buildings, (c) buildings with bars on the windows, and/or (d) litter were present within a half block of the respondent's residence. Other variables were considered but judged to have poor construct validity. For example, the question "Is the neighborhood shopping satisfactory?" was judged to be confounded by SES of the respondent and therefore would not universally represent poor shopping (e.g. presence of corner markets versus grocery stores versus high end retailers). These variables are broadly consistent with what others have termed social disorder' or 'neighborhood disorder' (Hadley-Ives et al., 2000; Li et al., 1999; Sampson et al., 1997). Others have also used perceptions of neighborhood quality in place of objective measures (e.g. Jang and Johnson, 2001; Latkin et al., 2005; Winstanley et al., 2008). Perceptions have been shown to be both a reliable and valid measure of objective assessments of neighborhood quality (Perkins et al., 1992; Perkins and Taylor, 1996; Stiffman et al., 1999). Our quality of the local environment variable differs from previous operationalizations as it represents the quality of the average MSA neighborhood as opposed to specific, defined neighborhoods.

The AHS collects information on various aspects of housing in the United States. It includes both national samples and metropolitan samples conducted on a rotating basis; technically two different surveys. The national samples were based on census enumerations of households and included approximately 55,000 households. The metropolitan area surveys consisted of 47 metropolitan areas interviewed on a rotating basis such that each MSA was included approximately every six years. The samples were representative of the metropolitan area and include at least 3,200 households. All responses were coded as the percent of respondents at the MSA level reporting an undesirable feature (e.g. percent of respondents reporting the presence of litter within a half block). The following seven MSAs were excluded from our analysis because they are not represented in the AHS: Ann Arbor, MI, Dayton-Springfield, OH, Harrisburg-Lebanon-Carlisle, PA, Louisville, KY-IN, Richmond-Petersburg, VA, San Juan-Bayamon, PR, and Wilmington-Newark, DE-MD. Sarasota-Bradenton, FL was excluded due to missing data.

We assessed the metropolitan political economy as the percent of the labor force that was unemployed, the percent of persons below the poverty line and the percent of households receiving public assistance. We used 1990 and 2000 US Census data to derive these measures for each MSA using the constituent counties as defined in 1993. These measures were modeled as the arithmetic mean of MSAs 1990 and 2000 values. Kaplan et al. (2005) documented worse health among single mothers after the Personal Responsibility and Work Opportunity Reconciliation Act (PRWORA) in 1996. Thus, while it is quite likely that intercensal variation in these three measures affected measures of population health, including IDU, it is difficult to know exactly when and how changes occurred without better data. In operationalizing each construct as a mean we are attempting only to compare average MSA economic circumstances.

Region of the country was defined using US Census definitions (West, Midwest, South, Northeast) with the following adjustments to make the categories more homogeneous politically, culturally and economically: Maryland, Delaware and Washington DC were moved to the Northeast; Texas was moved to the West; Oklahoma was moved to the Midwest (Friedman et al., 2006). We felt this categorization provided more homogenous groups with

respect to drug markets (Ciccarone and Bourgois, 2003), socio-spatial identities (e.g. The South ), and geopolitical alliances (e.g. The Rust Belt). MSAs with constituent counties in more than one state were assigned to a region based on their primary state.

Police officers per 10,000 population was derived from Law Enforcement Officers Killed or Assaulted (LEOKA) data using counts of active male and female officers (U.S. Department of Justice, 2005). LEOKA data was available for all years included. Spending on police protection was measured as the amount spent per capita per MSA on the "preservation of law and order, protection of persons and property from illegal acts, and the prevention, control, investigation, and reduction of crime" (e.g. the maintenance of regular police departments). This was derived from the U.S. Census Bureau's data on state and local government finances (U. S. Census Bureau, 2006). Spending figures for the appropriate counties were aggregated for function code 62. The years 1993 and 1994 do not have data and mean imputation was used for these values.

Population counts, used in the calculation of police officers per 10,000 and police spending per capita (denominator), population size, and offset (to calculate person-years at risk) were derived from the county population estimates from the Population Division of the US Census Bureau for the years 1992 – 2002 (U. S. Census Bureau, 2007).

### 2.4 Implication of Unit Analysis for Variables

There is a rich literature that operationalizes variables similar to those we employ in this study but measured at the neighborhood level as opposed to the metropolitan level. Neighborhoods and metropolitan areas are sufficiently different so as to alter the interpretation of these commonly used measures. For example, when modeled at the neighborhood level the percent unemployed or number of households receiving public assistance is usually interpreted to represent the construct of concentrated disadvantage. However, at the MSA level these variables may more closely approximate the condition of labor and housing markets or other aspects of the economy that may operate outside of any local jurisdiction (Osypuk and Galea, 2007). Rather than call this construct economic circumstances we employ the term political economy explicitly to reinforce the fact that political decisions such as PRWORA or the American Recovery and Reinvestment Act can dramatically influence these measures.

Our local environmental index represents the quality of the average MSA neighborhood as opposed to specific, defined neighborhoods. One component critical to understanding the meaning of any variable measuring the quality of an environment is the concept of experiential space. Experiential space can be thought of as the way people experience a location and internalize information; as the memories and emotions that a space evokes or engenders, which may be particularly relevant for mental health outcomes (Osypuk and Galea, 2007). With respect to the index employed in this analysis we are asking, do areas characterized by generally poor conditions have higher levels of IDU? rather than do individuals exposed to poor conditions have a greater uptake of IDU compared to individuals exposed to better conditions? Our index may have particular import as concepts of place may extend beyond an individual's immediate environment (Marchand and Meffre, 2008).

### 2.5 Statistical Analysis

The percent of residents responding yes to the four AHS questions in each MSA in each year was calculated. An index representing the quality of the local environment was created by taking the arithmetic mean of the four variables. Prior to creating the index, missing values were replaced with their mean (by MSA). Three MSAs had two years of observation in the AHS, 52 had five years, 19 had six and 15 had seven years of observation. The distribution of number of years of observation did not vary by region. Excluding the three MSAs with only two years of observation (Buffalo-Niagara Falls, NY, Charlotte-Gastonia-Rock Hill, NC-SC,

and Portland-Vancouver, OR-WA) did not alter our results substantively. The index can be interpreted as the mean percent of our four features in each MSA; the average unpleasantness.

We described the distribution of the quality of the local environment, metropolitan political economy, police officers per 10,000, police spending per capita, population size and IDUs in MSAs by examining trends over time graphically, and with medians, interquartile ranges (IQR) and ranges. We mapped IDU and the quality of the local environment in MSAs using ArcGIS 9.2 (Redlands, CA). Descriptive statistics and histograms of the IDU data indicated it was over-dispersed; we therefore used a negative binomial distribution to model our outcome in all regressions (Gardner et al., 1995). Regression models were constructed to assess associations between the quality of the local environment, metropolitan political economy, region of the country, police officers per 10,000, police spending per capita, population size, and IDU separately. A series of multivariate models were constructed entering the measures of metropolitan political economy in turn (due to high intercorrelations, $r \geq 0.70$, among the variables precluding mutual adjustment) and simultaneously accounting for region, police officers per 10,000, police spending per capita, and population size. As expected, the quality of the local environment index and our measures of political economy were correlated but not so high as to preclude mutual adjustment ($0.46 < r < 0.61$). We investigated whether there was an interaction between region and the quality of the local environment adjusting for one measure of metropolitan political economy, police officers per 10,000, police spending per capita, and population size. We ran additional analyses stratified by region to check for residual confounding. We entered the quality of the local environment index, police officers per 10,000, police spending, and population size as standardized values in all models (mean=0, SD=1) for ease of interpretation. Generalized estimating equations (GEE) were used to adjust for repeated measures on each MSA over time using a first order autoregressive correlation structure (Ballinger, 2004). We considered the relation between the quality of the local environment index, police officers per 10,000, police spending per capita, population size and IDU in the same year (unlagged) and also with the neighborhood index, police officers per 10,000, police spending per capita and population size lagged 1 year earlier (lagged) in order to mirror the hypothesized temporal relationships. We are aware of no theoretical work suggesting a 'correct' lag time. We therefore chose 1 year since transitions to injecting drugs from other forms of use can occur quickly (Fuller et al., 2005; Fuller et al., 2001). Our parameterization of the metropolitan political economy as mean values did not allow us to enter them as lags. Due to space limitations we report results of the lagged analyses only.

### 2.6 Approval

This study was approved by the Institutional Review Boards of the University of Michigan and of National Development and Research Institutes, Inc.

## 3.0 Results

Table 1 presents characteristics of the social environment for the 88 MSAs in our sample. Overall, the median number of IDUs was 99 per 10,000. This ranged from a low of 30 per 10,000 in Youngstown-Warren, OH in 1992 to a high of 348 per 10,000 in El Paso, TX in 1992. The MSAs in our sample were characterized by a wide range of social and economic characteristics over time and place; the median value of the quality of the local environmental index was 10.60% (IQR: 7.93 – 14.30). The percent unemployed ranged from 2% to 9%. Percent of persons below the poverty line ranged from 5% to 25 %. The percent of households receiving public assistance ranged from 2.5% to 12.4%.

The median number of police officers per 10,000 was 22 (IQR: 18 – 27), the median police spending (per capita) was $1,392 (IQR: $1,126 – $1,717), and the median population size was 1.34 million people (range: 0.50 to 9.78 million). Figure 1a is a map of the 88 MSAs included

in our sample, showing the mean number of IDUs per 10,000 per MSA, in quartiles, based on the cross-section pooled from 1992 – 1994. Figure 1b is a map of the 88 MSAs included in our sample, showing quartiles of the quality of the local environment index per MSA based on the cross-section pooled from 1992 – 1994. Figures 2 and 3 reproduce these maps but over the time periods 1995 – 1998, and 1999 – 2002 respectively. Quartiles were determined using data from all three time periods. Generally, over the three time periods IDU and poor quality local environments were most concentrated in the West, followed by the Northeast, the South and had the lowest rates in the Midwest.

Table 2 presents bivariate and multivariate lagged models describing the relation between our characteristics of the social environment and IDU. The quality of the local environment index, the three measures of metropolitan political economy and region (Midwest is reference) were positively and significantly associated with IDU in bivariate models whereas our control variables were not. In models 1–3, when accounting for each measure of metropolitan political economy in turn, there was a positive relation between the quality of the local environment index and IDU as well as a positive relation between the measure of metropolitan political economy and IDU. All region dummy variables were significantly and positively associated with IDU except for the South region, which was not significantly associated with IDU in model 2 when our measure of metropolitan political economy was the percent of persons below the poverty line. Police officers per 10,000, police spending per capita and population size persisted in their null associations with IDU. Model 4 demonstrated a significant positive interaction between the South region and the quality of the local environment index, a marginally non-significant negative association between the Northeast and the quality of the local environment index, and a null association between the West and the quality of the local environment index with IDU.

Table 3 presents multivariate lagged models describing the relation between our characteristics of the social environment and IDU stratified by region. The models for the West region showed a significant and positive association between the quality of the local environment index, each measure of metropolitan political economy and IDU. The models for the Northeast demonstrated a significant (both marginal and traditional levels) positive relation between the metropolitan political economy and IDU. There was a null association between the quality of the local environment index and IDU across all 3 models. The models for the South displayed strong positive associations between the quality of the local environment index and IDU and null associations between the metropolitan political economy and IDU. The models for the Midwest region showed a significant positive association between the quality of the local environment index and IDU. It was smaller in magnitude than that observed for the West or the South region. The metropolitan political economy was unassociated with IDU in the Midwest.

Compared to the lagged models the unlagged models replicating the analyses in table 3 showed strong relations between all measures of the metropolitan political economy and IDU in all regions. The quality of the local environment index had null associations with IDU in the West and Northeast, and small protective effects on IDU in the South and Midwest.

## 4.0 Discussion

In a study of 88 of the largest US MSAs from 1992 to 2002 we found that lower quality local environments and worse metropolitan political economies (higher unemployment rates, more people below the poverty line and more households on public assistance) were independently and jointly associated with higher IDU rates. These associations persisted after accounting for region of the country, police officers per 10,000, police spending per capita, and population size. Further analyses indicated heterogeneity of effect by region whereby the quality of the

local environment was associated with IDU strongest in the South followed by the West and Midwest, and the metropolitan political economy was associated with IDU in the West and Northeast.

Although we are not aware of prior work that has jointly investigated the relations among the quality of the local environment, metropolitan political economy, and IDU in a sample of large metropolitan areas our observations about the quality of the local environment and political economy are consistent with previous studies carried out in specific cities (e.g. Bell et al., 1998; Galea et al., 2003; Latkin et al., 2005) and with national level data (e.g. Winstanley et al., 2008). There are several mechanisms that may explain the observed associations. At the macro-level our results are likely the reflection of differential political economic trajectories of metropolitan areas with concomitant effects on the quality of the local environment exacerbating population health outcomes including IDU prevalence (Bell et al., 1998; Bourgois, 2003a; Freudenberg et al., 2006; Waitzkin, 2007; Wallace, 1990). In light of the larger literature, it is possible an interaction between neighborhood and metropolitan conditions exists whereby residence in a neighborhood characterized by poor environmental and economic circumstances in a metropolitan area characterized by generally poor environmental conditions with few economic opportunities is the most conducive to IDU. This is similar to an interaction reported by Boardman et al. (2001) between individual and neighborhood level SES increasing the risk of drug use. However, it is important to keep arguments of structural determinism in perspective; there are examples of community change in the absence of improved economic circumstances (Friedman et al., 2007a), and we acknowledge the dynamic interplay of multiple aspects of the macro environment in shaping population health (Friedman et al.; Galea, 2007).

We observed null or small protective effects for our quality of the local environment index in unlagged models but strong, positive effects in lagged models. This may indicate we are capturing psychological distress resulting from prolonged exposure to a poor quality local environment possibly leading to the adoption of IDU as a coping mechanism in response to noxious stimuli and/or structural violence (Bourgois et al., 2004; Cockerham, 2005; Fullilove, 1993; Galea et al., 2005a; Lillie-Blanton et al., 1993; Taylor et al., 1997; Wilson and Kelling, 1982) as opposed to attributes of the local environment that may produce a more immediate effect such as an increase in the number of treatment facilities. Because we parameterized the metropolitan political economy as a mean we were unable to enter it as a lag. However, the presence of stronger associations for our measures of political economy when we did not specify a lag compared to a one year lag time suggests that economic circumstances are particularly germane to substance use prevention when considering fluctuations in short term numbers of IDUs.

At the micro level, evidence from other papers suggests that IDU may be a coping mechanism in response to psychopathology resulting from exposure to a noxious environment (Friedman, 2002; Latkin and Curry, 2003; Paternoster and Mazerolle, 1994; Rhodes and Jason, 1990; Roberts, 2000). For example Latkin et al. (2005) used structural equation modeling to show positive relations between social disorder and distress (defined as depression), and between distress and both injection frequency and equipment sharing among a prospective sample of IDUs in Baltimore. Several authors have documented power differentials stratified by gender, SES, race/ethnicity and locations in social hierarchies, and their associations with risky drug use or exposure to blood borne pathogens (Bourgois, 2003a, b; Bourgois et al., 1997; Bourgois et al., 2004; Friedman et al., 1998; Lovell, 2002; Zierler and Krieger, 1997). As discussed by Friedman (2002) these power differentials manifest in the quality of the local environment, opportunities for economic advancement and a variety of other societal structures, and many people use drugs to help deal with the pressures resulting from these power differentials. Our results, showing that poor quality local environments and political economic circumstances

may be important determinants of IDU across MSAs, may then reflect the aggregate increase in IDU among individuals using IDU as a coping mechanism in response to traumatic experiences related to residence in a MSA characterized by a poor quality local environment and poor political economic circumstances.

There is a paucity of work assessing regional variation in the determinants of IDU (Ciccarone and Bourgois, 2003; Cooper et al., 2005; Cooper et al., 2007b). Our findings suggest that differences in regional social and economic conditions may be associated with IDU prevalence across the country. However we found persistent regional heterogeneity in IDU that were unaccounted for by the quality of the local environment, political economic circumstances, policing, and population size. Heterogeneity of the supply and demand side of the drug market may partially account for regional differences in IDU (Substance Abuse Mental Health Services Administration, 2007; U. S. Drug Enforcement Administration, 2008). Other work has found regional heterogeneity in residential segregation of blacks linked to IDU prevalence (Cooper et al., 2007b), and regional Latino/white injecting disparities, which the authors hypothesized may have been linked to differential patterns of migration and residential segregation by region (Cooper et al., 2005). Future work should assess the interrelation between residential segregation and other manifestations of social-structural racism, neighborhood conditions, economic circumstances, and regional heterogeneity in IDU given the historical relations between many of these variables.

In lagged models (table 2, models 1 – 3) we showed that, based on the national average, a one SD change in our quality of the local environment index is associated with approximately a 3 – 4% difference in the number of IDUs. We also showed that a 1% change in our measures of the metropolitan political economy are associated with between 4% and 10% differences in the number of IDUs. These percentages represent potentially substantial differences in numbers of IDUs in MSAs and the presence of regional variation suggests remarkable heterogeneity across the country (table 3). For example, in 2002 the Albuquerque, NM MSA had 184 IDU per 10,000 and 9,066 total IDU (Brady et al., 2008). Thus a one SD decrease in our quality of the local environment index would be associated with a decrease of 7 IDU per 10,000 or 363 fewer IDU overall. Whereas, in 2002 the Atlanta, GA MSA had 48 IDU per 10,000 and 14,602 total IDU (Brady et al., 2008). Thus a one SD decrease in our quality of the local environment index would be associated with a decrease of 5.8 IDU per 10,000 or 1,752 fewer IDU overall.

To the extent the mechanisms described above reflect casual relations our results suggest several policy alternatives. Consideration of the conditions of the labor market, modes of public assistance, and the role of the state in ensuring livable, dignifying environments should be given equal consideration alongside medicalized interventions targeting individual drug users that have traditionally dominated the policy discourse. Furthermore, these options need to provide not only economic solvency but also a sense of purpose and meaning if we expect them to curtail drug use or employment in the drug economy (Bourgois, 2003b). Materially this means that schools need to be improved, punitive welfare laws should be rescinded, and economic reforms (for a snapshot of the complicated relationship between government, corporations and individuals in a market economy in the context of the recent credit crisis see e.g. The Economist, 2009; Norris, 2009; Schneiderman, 2008) need to be undertaken. Friedman (2002) suggests that, to the degree that social conditions cause drug use, laws targeted at users and dealers are a misdiagnosis of the problem, more akin to treating the symptoms rather than the causes and should therefore be rescinded. The options presented here represent only a few out of many. It is not our intention to proscribe specific policies, which is beyond the scope of our data. Rather our intention is to shed light on the ways macrosocial factors shape the lives of individuals and offer that the material impact of policies should be considered before they are implemented. History reminds us that urban locations are created through conscious, formal decision making processes (Bell et al., 1998), that the prevailing political climate is strongly

related to the economic conditions and health (Waitzkin, 2007), and that disregard for social safety nets can have dramatic consequences for the health of populations (Freudenberg et al., 2006). Still, further research is needed to clarify the specific mechanisms linking both the quality of the local environment and the political economy to IDU in order to better inform policy makers (Friedman and Touze, 2006).

There are several limitations to this study. First, our quantification of the quality of the local environment required imputation, and there is measurement error associated with each of our independent variables as this study was subject to the limitations of the available data. Second, a concern in this analysis is causal directionality. However, we were able to enter our neighborhood index as a lagged variable mirroring our assumption about the temporal relationship between the social environment and IDU. Third, there is little reason to believe that one year is the 'correct' lag time for our characteristics of the social environment to predict IDU given the importance of lifecourse effects on trajectories of drug use (Bourgois, 2003b). However, considering the complexity of human behavior (Resnicow and Vaughan, 2006) transitions to injection from other forms of use or relapses after periods of cessation can occur relatively quickly and therefore one year is a reasonable approximation. While we were not able to fully investigate the reciprocal relationship that surely exists between our variables this data highlights the importance of the social and economic environment in shaping population health. Fourth, some have cautioned against ignoring social selection when inferring causation in social epidemiologic research (Yen and Syme, 1999). Given that our unit of analysis was the MSA, as opposed to neighborhoods, concern about the salience of the drift hypothesis is mitigated. However, recent work suggests that young IDUs may be highly mobile (Hahn et al., 2008) warranting further investigation into the extent of travel by drug users and its relation to trajectories of drug use. Fifth, there is no standard measure of the quality of the local environment making it unclear how our results compare to those reported elsewhere. Sixth, we were unable to control for police policies or practices in MSAs, which may have a greater association with drug use, as we are aware of no systematic listing of policies for all precincts in all MSAs. Seventh, our dependent variable is an estimate and is subject to all the limitations Brady and colleagues (2008) address.

Eighth, according to 2005 population estimates the excluded MSAs (Wilmington-Newark, DE-MD, Ann Arbor, MI, Harrisburg-Lebanon-Carlisle, PA, Sarasota-Bradenton, FL, Dayton-Springfield, OH, Louisville, KY-IN, Richmond-Petersburg, VA and San Juan-Bayamon, PR) represented the 9th, 10th, 11th, 14th, 30th, 35th, 36th and 78th smallest MSAs in our sample respectively. With the exception of San Juan-Bayamon, PR these are all in the bottom half of our sample possibly limiting the ability to generalize our results to smaller MSAs. Two of these MSAs come from the Northeast, three from the South and two from the Midwest making it unlikely that there is a region specific bias. San Juan-Bayamon represents the only MSA in the original sample from a US territory as opposed to a state. While San Juan is of interest from a public health perspective the mechanisms linking the quality of the local environment and political economy to IDU in San Juan are likely qualitatively different than for MSAs located within the Union (Bourgois, 2003b).

Notwithstanding these limitations we found a positive association between worse quality local environments, political economic circumstances and IDU in a longitudinal sample of large US metropolitan areas. Our study shows that IDU prevalence is associated with particular characteristics of MSAs and tells us little about the influence of these characteristics on individual behavior (Diez-Roux, 1998; Morgenstern, 1995). Importantly we observe inter-area variation in rates of behavior associated with measures of the social and economic environment. This analysis supports the body of work assessing the influence of the social and economic environment on drug use generally and IDU specifically. Further work should focus on elucidating the mechanisms linking the social and economic environment to drug use.

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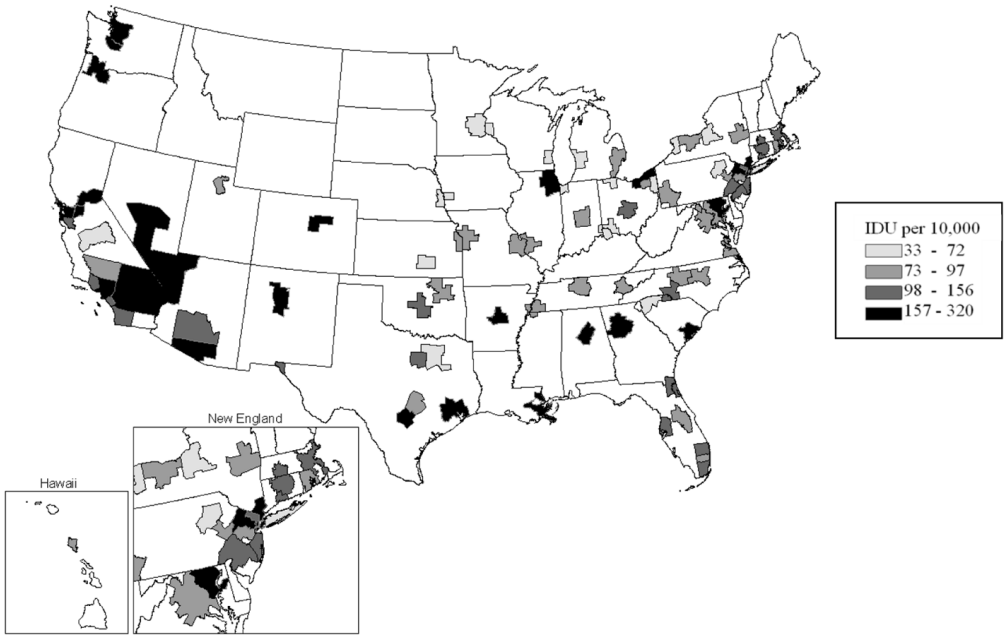
1a.




1b.

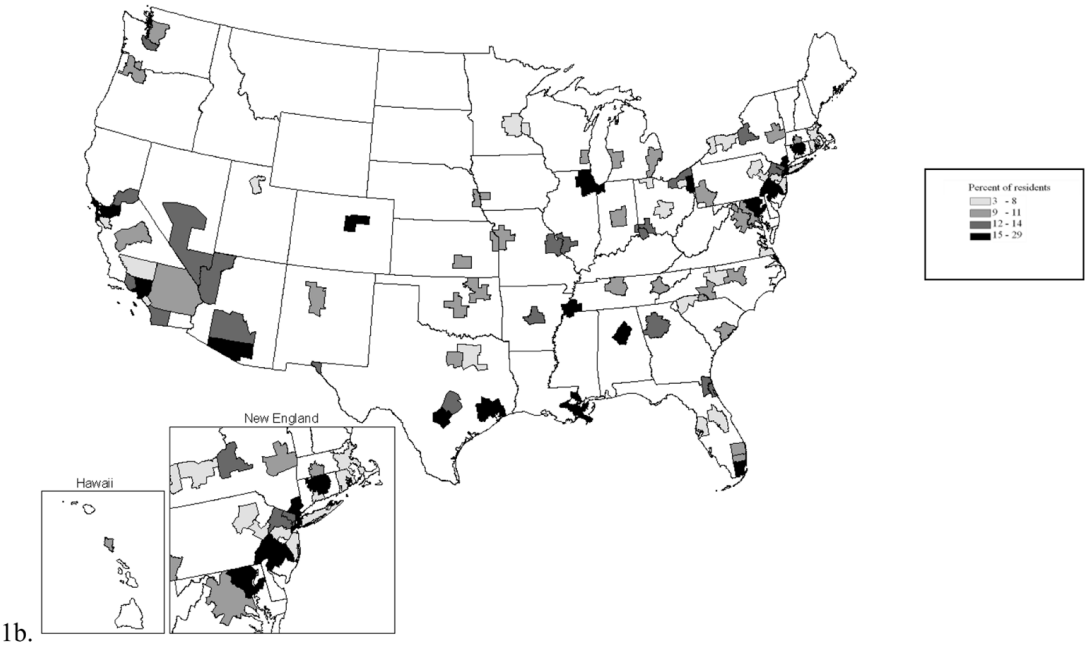



**Figure 1.**

Mean number of injection drug users per 10,000 (1a) and mean quality of the local environment index (1b) in 88 U.S. metropolitan statistical areas 1992 – 1994 (averaged over time).

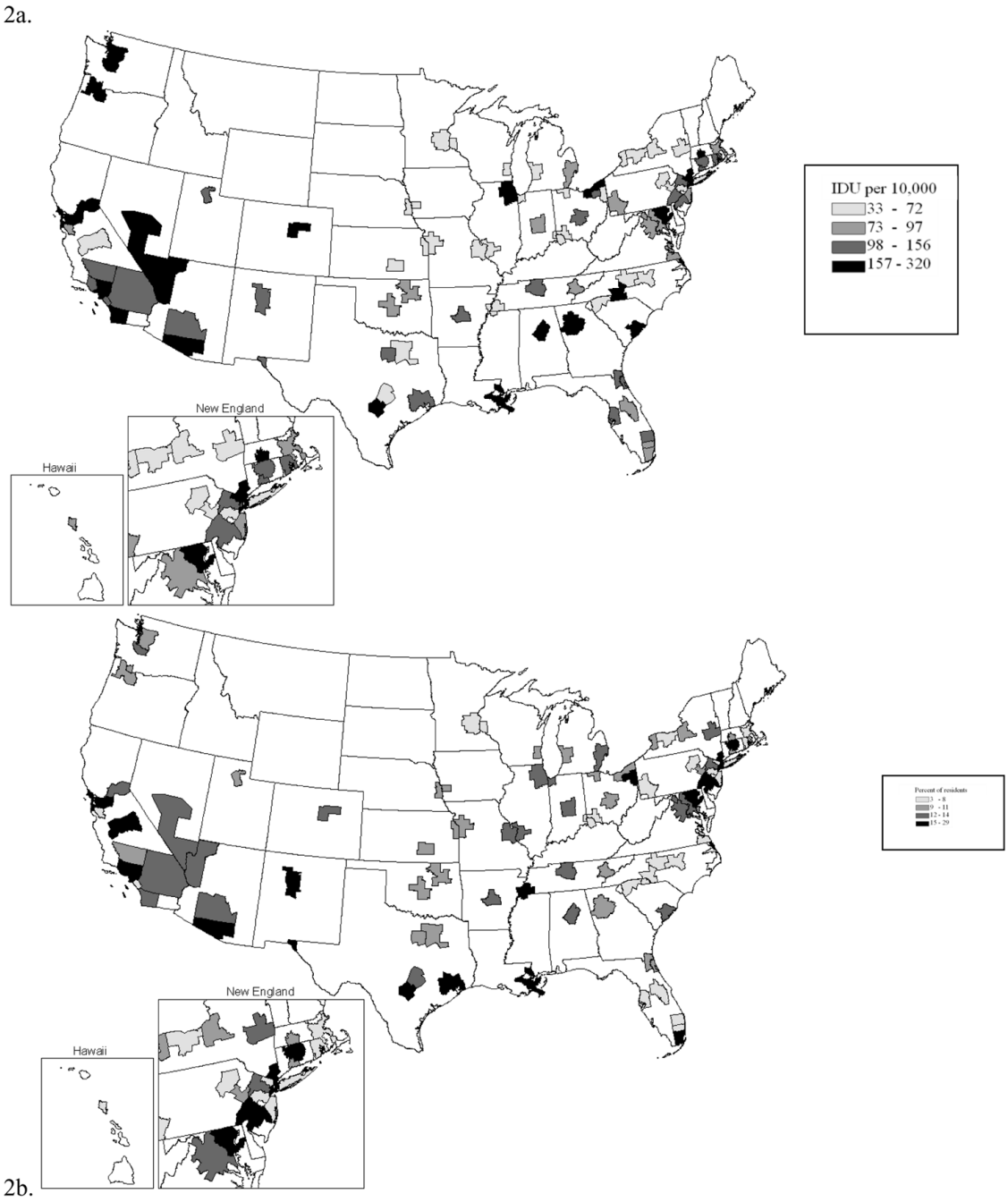



**Figure 2.**
Mean number of injection drug users per 10,000 (2a) and mean quality of the local environment index (2b) in 88 U.S. metropolitan statistical areas 1995 – 1998 (averaged over time).

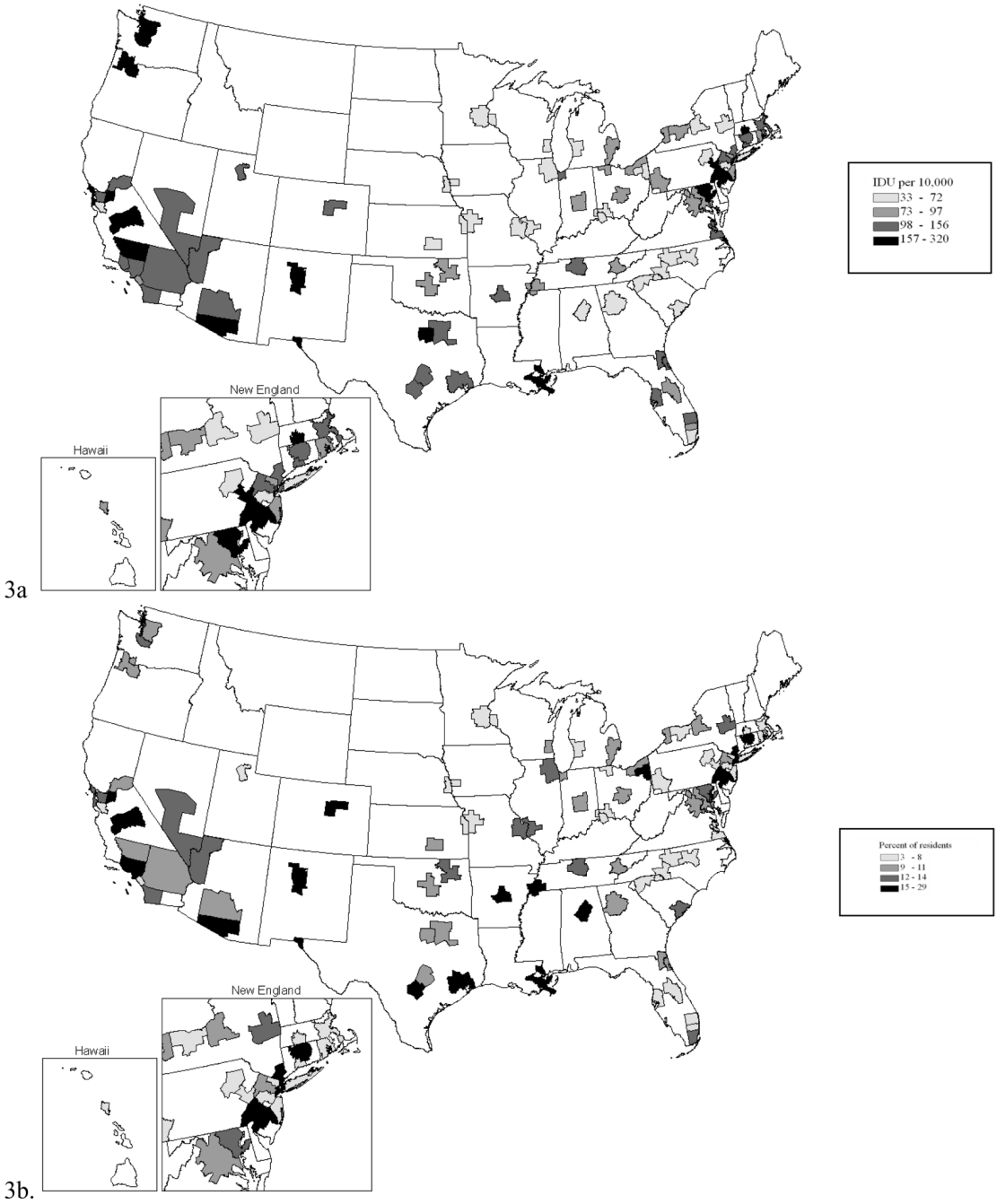



**Figure 3.**
Mean number of injection drug users per 10,000 (3a) and mean quality of the local environment index (3b) in 88 U.S. metropolitan statistical areas 1999 – 2002 (averaged over time).

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**Table 1**

Characteristics of 88 US Metropolitan Statistical Areas 1992–2002.

| Variable | Median | IQR | Min | Max |
|---|---|---|---|---|
| Number of injection drug users (per 10,000) | 99.05 | 70.31 – 154.80 | 30.04 | 348.49 |
| Quality of the local environment index[a] | 10.60 | 7.93 – 14.30 | 2.35 | 38.57 |
| Metropolitan political economy | | | | |
| Percent unemployed | 4.46 | 4.01 – 5.15 | 1.80 | 9.03 |
| Percent persons below poverty line | 10.95 | 9.22 – 12.82 | 4.85 | 25.31 |
| Percent households on public assistance | 4.82 | 3.88 – 6.07 | 2.54 | 12.39 |
| Controls | | | | |
| Police officers (per 10,000) | 22.05 | 18.13 – 26.90 | 1.91 | 166.66 |
| Police spending (per capita) | 1391.85 | 1125.53 – 1717.45 | 233.92 | 5189.41 |
| Population size | 1338489 | 847932 – 2242408 | 500278 | 9776424 |

[a]*Note:* the quality of the local environment index is the mean percent of respondents per Metropolitan Statistical Area reporting (a) bothersome crime, (b) abandoned buildings within a half block, (c) bars on windows within a half block and (d) trash within a half block.

**Table 2**

The relation between injection drug use (year t) and quality of the local environment, metropolitan political economy (year t-1), and region of the country at different time points in multivariate adjusted models accounting for police presence, and population size in 88 Metropolitan Statistical Areas, 1992 – 2002.

| Variable | Bivariate | | Model 1 | | Model 2 | | Model 3 | | Model 4 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | RR | 95% CI | RR | 95% CI | RR | 95% CI | RR | 95% CI | RR | 95% CI |
| Quality of the local environment index[a,b] | 1.03 | (1.01, 1.06) | 1.03 | (1.01, 1.06) | 1.03 | (1.01, 1.05) | 1.04 | (1.01, 1.06) | 1.03 | (1.00, 1.06) |
| Metropolitian political economy | | | | | | | | | | |
| Percent unemployed | 1.18 | (1.12, 1.25) | 1.10 | (1.05, 1.15) | | | | | 1.09 | (1.04, 1.15) |
| Percent persons below poverty line | 1.05 | (1.03, 1.07) | | | 1.04 | (1.02, 1.05) | | | | |
| Percent households on public assistance | 1.09 | (1.05, 1.13) | | | | | 1.06 | (1.04, 1.09) | | |
| Region | | | | | | | | | | |
| West | 2.37 | (2.02, 2.78) | 2.19 | (1.87, 2.58) | 2.22 | (1.89, 2.60) | 2.27 | (1.95, 2.65) | 2.21 | (1.88, 2.59) |
| Northeast | 1.59 | (1.25, 2.02) | 1.58 | (1.24, 2.02) | 1.69 | (1.34, 2.14) | 1.62 | (1.28, 2.05) | 1.58 | (1.24, 2.01) |
| South | 1.28 | (1.05, 1.55) | 1.20 | (1.01, 1.42) | 1.14 | (0.96, 1.35) | 1.25 | (1.05, 1.50) | 1.22 | (1.03, 1.45) |
| Midwest | reference | | reference | | reference | | reference | | reference | |
| Controls | | | | | | | | | | |
| Police officers (per 10,000)[b] | 0.99 | (0.98, 1.01) | 1.00 | (0.99, 1.02) | 1.00 | (0.98, 1.02) | 1.00 | (0.98, 1.02) | 1.00 | (0.98, 1.01) |
| Police spending (per capita)[b] | 0.99 | (0.98, 1.01) | 1.00 | (0.99, 1.02) | 1.00 | (0.99, 1.02) | 1.00 | (0.99, 1.02) | 1.00 | (0.99, 1.01) |
| Population size | 0.98 | (0.89, 1.08) | 0.98 | (0.92, 1.03) | 0.98 | (0.93, 1.03) | 0.97 | (0.92, 1.02) | 0.98 | (0.93, 1.04) |
| Interaction | | | | | | | | | | |
| West*local environment index | | | | | | | | | 1.01 | (0.97, 1.05) |
| Northeast* local environment index | | | | | | | | | 0.97 | (0.94, 1.00) |
| South* local environment index | | | | | | | | | 1.09 | (1.01, 1.17) |
| Midwest* local environment index | | | | | | | | | reference | |

[a] *Note:* the quality of the local environment index is the mean percent of respondents per Metropolitan Statistical Area reporting (a) bothersome crime, (b) abandoned buildings within a half block, (c) bars on windows within a half block and (d) trash within a half block.

[b] all models have standardized values (mean = 0, SD = 1) for quality of the local environment index, police officers per 10,000, police spending per capita, and population size

** lagged models have quality of the local environment index, police officers per 10,000, police spending per capita, and population size entered at year t-1, injection drug use entered at year t.

**Table 3**

The relation between injection drug use (year t) and quality of the local environment, and metropolitan political economy (year t-1) stratified by region of the country in multivariate adjusted models accounting for police presence, and population size in 88 Metropolitan Statistical Areas, 1992 – 2002.

| **Variable** | **West** | | **West** | | **West** | | **Northeast** | | **Northeast** | | **Northeast** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **RR** | **95% CI** | **RR** | **95% CI** | **RR** | **95% CI** | **RR** | **95% CI** | **RR** | **95% CI** | **RR** | **95% CI** |
| Quality of the local environment index[a,b] | 1.04 | (1.01, 1.07) | 1.04 | (1.01, 1.07) | 1.04 | (1.01, 1.07) | 1.00 | (0.98, 1.01) | 1.00 | (0.98, 1.01) | 1.00 | (0.98, 1.01) |
| Metropolitian political economy | | | | | | | | | | | | |
| Percent unemployed | 1.09 | (1.03, 1.16) | | | | | 1.12 | (0.95, 1.31) | | | | |
| Percent persons below poverty line | | | 1.03 | (1.00, 1.06) | | | | | 1.04 | (0.99, 1.09) | | |
| Percent households on public assistance | | | | | 1.05 | (1.03, 1.08) | | | | | 1.12 | (1.05, 1.21) |
| Controls | | | | | | | | | | | | |
| Police officers (per 10,000)[b] | 1.00 | (0.98, 1.01) | 0.99 | (0.98, 1.01) | 0.99 | (0.98, 1.01) | 1.01 | (0.99, 1.02) | 1.01 | (0.99, 1.02) | 1.01 | (0.99, 1.02) |
| Police spending (per capita)[b] | 0.96 | (0.93, 0.99) | 0.96 | (0.93, 0.99) | 0.96 | (0.93, 0.99) | 0.99 | (0.97, 1.00) | 0.99 | (0.97, 1.00) | 0.99 | (0.97, 1.00) |
| Population size | 0.93 | (0.86, 1.00) | 0.93 | (0.86, 1.00) | 0.93 | (0.86, 1.00) | 1.10 | (0.98, 1.23) | 1.08 | (0.95, 1.22) | 1.06 | (0.94, 1.20) |
| Variable | South | | South | | South | | Midwest | | Midwest | | Midwest | |
| | RR | 95% CI | RR | 95% CI | RR | 95% CI | RR | 95% CI | RR | 95% CI | RR | 95% CI |
| Quality of the local environment index[a,b] | 1.12 | (1.05, 1.19) | 1.12 | (1.05, 1.19) | 1.12 | (1.05, 1.19) | 1.03 | (1.00, 1.06) | 1.03 | (1.00, 1.06) | 1.03 | (1.00, 1.06) |
| Metropolitian political economy | | | | | | | | | | | | |
| Percent unemployed | 0.99 | (0.87, 1.14) | | | | | 1.07 | (0.94, 1.22) | | | | |
| Percent persons below poverty line | | | 0.99 | (0.94, 1.04) | | | | | 1.04 | (0.97, 1.12) | | |
| Percent households on public assistance | | | | | 0.99 | (.91, 1.06) | | | | | 1.01 | (0.89, 1.13) |
| Controls | | | | | | | | | | | | |

| Variable | West | | West | | West | | Northeast | | Northeast | | Northeast | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | RR | 95% CI | RR | 95% CI | RR | 95% CI | RR | 95% CI | RR | 95% CI | RR | 95% CI |
| Police officers (per 10,000)[b] | 0.97 | (0.93, 1.00) | 0.97 | (0.93, 1.00) | 0.97 | (0.93, 1.00) | 1.28 | (1.00, 1.64) | 1.26 | (0.98, 1.63) | 1.31 | (1.06, 1.63) |
| Police spending (per capita)[b] | 1.06 | (1.02, 1.10) | 1.06 | (1.02, 1.10) | 1.06 | (1.02, 1.10) | 1.04 | (1.02, 1.07) | 1.04 | (1.02, 1.07) | 1.04 | (1.02, 1.07) |
| Population size | 0.88 | (0.71, 1.10) | 0.88 | (0.70, 1.09) | 0.88 | (0.71, 1.09) | 0.91 | (0.85, 0.97) | 0.93 | (0.86, 0.99) | 0.92 | (0.85, 0.98) |

[a] *Note:* the quality of the local environment index is the mean percent of respondents per Metropolitan Statistical Area reporting (a) bothersome crime, (b) abandoned buildings within a half block, (c) bars on windows within a half block and (d) trash within a half block.

[b] all models have standardized values (mean = 0, SD = 1) for quality of the local environment index, police officers per 10,000, and police spending per capita.

[**] lagged models have quality of the local environment index, police officers per 10,000, police spending per capita, and population size entered at year t-1, injection drug use entered at year t.