Police drug crackdowns and hospitalisation rates for illicit-injection-related infections in New York City

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Abstract

Using longitudinal data, this analysis tests the hypothesis that eight police drug crackdowns implemented in 27 New York City police precincts between 1995 and 1999 were associated with subsequent increases in monthly precinct-specific hospitalisation rates for illicit-injection-related abscesses, cellulitis, and endocarditis. Crackdowns are sustained police initiatives designed to reduce the possession and sale of illicit drugs through heightened surveillance and arrests of drug users and street-level dealers. We linked hospitalisation data (48,986 illicit-injection-related abscess or cellulitis cases and 5452 illicit-injection-related endocarditis cases) and arrest and United States Census data to police precincts to calculate hospitalisation and arrest rates. Analyses indicate that drug-related arrest rates climbed 39% in the crackdowns’ first year compared with the previous year. Contrary to our hypothesis, we found evidence of a stasis or decline in hospitalisation rates in the crackdowns’ first year, based on multivariate Poisson regression models that included sensitivity analyses that accounted for the increased incarceration of injectors after each crackdown’s onset. We discuss several possible explanations for these findings and conclude that future research is warranted regarding the relationship between police strategies and drug users’ health that incorporates inmate health data and both individual-level and precinct-level data.

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Arrests for drug possession in the United States have more than doubled over the course of the past two decades from 540,800 in 1982 to 1,235,700 in 2002 (Federal Bureau of Investigation, 2003). This increase partially reflects a shift in domestic drug control policy from targeting upper-level dealers and distributors to focusing on street-level dealers and users (Boyum & Kleinman, 1994; Kelling & Moore, 1985; Moore, 1990; Williams, 1990). Research suggests that this shift may imperil drug injectors’ health: a small but growing number of qualitative and cross-sectional quantitative studies have concluded that injectors who are fearful of arrest are more likely to borrow syringes and other injection equipment, inject rapidly and miss their intended vein, and skip cleaning their injection site than are other injectors (Aitken, Moore, Higgs, Kelsall, & Kerger, 2002; Bluthenthal, Kral, Erringer, & Kahn, 1999; Cooper, Moore, Gruskin, & Krieger, in press; Maher & Dixon, 1999). Fear of arrest may also impair the ability of syringe exchange programs to provide sterile syringes and other services that reduce the possible harms of injection drug use (Bluthenthal, Kral, Erringer, & Edlin, 1999; Bluthenthal, Lorvick, Kral, Erringer, & Kahn, 1999; Cooper, Moore, Gruskin, & Krieger, in press; Moore & Dixon, 1999).
To augment knowledge about the impact of drug crackdowns, and hence policing policies, on illicit-drug injectors’ health, this analysis uses longitudinal data to test the hypothesis that the initiation of these eight crackdowns between 1995 and 1999 was associated with an increase in monthly, precinct-specific hospitalisation rates for illicit-injection-related abscesses, cellulitis, and endocarditis within the 27 crackdown precincts as compared with baseline rates in these precincts during the months preceding the crackdowns. Abscesses, cellulitis, and endocarditis have been linked with practices that previous studies have found to be related to injectors’ fear of arrest, including borrowing and re-using syringes, not cleaning one’s injection site prior to injecting drugs, and missing an intended vein (Herb, Watters, Case, & Petitti, 1989; Murphy et al., 2001; Vlahov, Sullivan, Astemborski, & Nelson, 1992).

Methods

The analysis consisted of five stages: (1) we identified the location and initiation dates of all crackdowns implemented in NYC during the study period and modelled their intensity; (2) we described the sociodemographic composition of each NYC precinct using United States (US) Census data; (3) we calculated precinct-specific monthly rates of hospitalisations for illicit-injection-related abscesses, cellulitis, and endocarditis using New York State hospitalisation data and US Census data; (4) we tested the hypothesis that the crackdowns were followed by an increase in the precinct-specific hospitalisation rates of the infections of interest; and (5) we augmented our statistical modelling with sensitivity analyses that attempted to account for the incarceration of injectors who developed an illicit-injection-related abscess, cellulitis, or endocarditis infection while living in the community and who would have contributed cases to the case count had they not been incarcerated before they could seek treatment at one of the community-based hospital facilities that were the source of our infection data (as described below).

All analyses were run on SAS 8.2 software. The Harvard School of Public Health Human Subjects Committee and the New York State Statewide Planning and Research Cooperative System (SPARCS) Institutional Review Board approved study protocols.

Stage 1: Identifying the crackdowns’ locations, initiation dates, and intensities

Data regarding the locations and initiation dates of drug crackdowns occurring in NYC between 1995 and 1999 were acquired through NYPD’s Narcotics Division and newspaper reports of mayoral press conferences. To determine whether the intensity of the crackdowns changed during their implementation, we investigated arrest patterns in crackdown precincts, before and after the crackdowns’ initiations, using a New York State Division of Criminal Justice Services...
(NYSDCJS) database. NYSDCJS contains information on the major charge in the arrest (i.e., if an individual is arrested for two or more charges, only the most serious is reported), the month and year in which the arrest was made, and the precinct reporting the arrest (New York Division of Criminal Justice Services, 2000). NYSDCJS data, combined with information on precinct population size, were used to calculate the arrest rate for each precinct each month before and during each crackdown’s implementation; the methods used to calculate precinct population size are described in the next section.

Exploratory analyses of these data suggest that arrest rates rose markedly in the months following the crackdowns’ onset. The median monthly precinct-specific arrest rate for drug-related offences climbed 39%, from 201 to 279 arrests per 100,000 precinct residents, comparing the 12 months preceding and following the crackdown’s onset. Similarly, the median monthly precinct-specific arrest rate for all offences increased by 17% over the same time period, from 559 per 100,000 residents to 652 per 100,000 residents. As is evident in Fig. 1, arrest rates surged in the first quarter of the crackdown and then were relatively sustained thereafter. Additional analyses indicate that the quarter prior to the crackdowns’ onset saw a gradual ramping up in arrest rates in some crackdown precincts, whereas arrest rates in other crackdown precincts declined during these months, a pattern that suggests that the crackdowns were preceded by some type of preparatory period. Accordingly, we identified four apparent crackdown stages:

1) Baseline: 4–15 months prior to crackdown onset;
2) Preparation: quarter prior to crackdown onset;
3) Initiation: month of crackdown onset;
4) Crackdown quarters: four quarters following crackdown onset.

Stage 2: describing precinct sociodemographic characteristics

Past research suggested that precinct racial/ethnic, poverty, and age composition and precinct borough might hold salience for the patterning of outcomes across precincts over time (Chen & Kandel, 1995; Fordyce, Shum, Singh, & Forlenza, 1998; Friedman et al., 1999; Haverkos, Turner, Moolchan, & Calet, 1999; Herb et al., 1989; Marzuk et al., 1997; Raveis & Kandel, 1987). Given this research, we posited that, in addition to precinct crackdown status, covariates should include precinct racial/ethnic composition, age structure, borough, and poverty composition. Precinct racial/ethnic composition was operationalised as a continuous variable describing the percent of residents who were non-Hispanic white; precinct age structure was operationalised as the percent of residents aged ≤17 years, 18–64 years, and ≥65 years. Precinct poverty composition was operationalised as a continuous variable describing the percent of residents subsisting below the federal poverty line; this variable was dichotomised in multivariate analyses to denote whether the precinct qualified as a federal poverty area, or an area in which 20% of the population is living in poverty (U.S. Census Bureau, 1995).

To construct sociodemographic variables regarding each precinct’s racial/ethnic and age composition, we used 1990 and 2000 Census block-level data. US Census blocks are the smallest unit of Census geography and are delineated by

![Fig. 1. Median precinct-specific drug-related arrest rates and total arrest rates in the four quarters before and after the initiation of eight police drug crackdowns in 27 New York City police precincts.](image)
visible and invisible boundaries such as streets and city lines (U.S. Census Bureau, 2003). To estimate the total number of individuals residing in each precinct during each month of the study period, we first used ArcView 3.2 software to geocode NYC 1990 and 2000 Census blocks to the city’s 76 police precincts and then summed population counts across all of the Census blocks comprising each precinct. Where precinct boundaries crossed 1990 or 2000 Census block lines, each block’s population was distributed across the resulting block fragments in proportion to the fragments’ surface area. These data were used to calculate each precinct’s population size, the percent of precinct residents who were non-Hispanic white, and each precinct’s age structure for 1990 and 2000. Assuming linear population change over time, we then interpolated each precinct’s racial/ethnic and age composition for each month of the study period using 1990 and 2000 data.

Data concerning precinct poverty status were estimated using census block group data because the Census Bureau does not release poverty data at the block level (U.S. Census Bureau, 2000). Census block groups are clusters of Census blocks containing between 250 and 550 housing units (U.S. Census Bureau, 2003). Census block groups (1990 and 2000) were mapped onto police precincts using the same methods as described for Census blocks and precinct-specific poverty figures interpolated for each month of the study period using 1990 and 2000 data.

Stage 3: Calculation of hospitalisation rates

The outcomes of interest were the monthly precinct-specific hospitalisation rates of illicit-injection-related abscesses, cellulitis, and endocarditis. Hospitalisation rate numerators were the number of hospitalisations for an illicit-injection-related abscess, cellulitis, or endocarditis infection during a particular month in a particular precinct. Rate denominators consisted of the number of adults (aged 18–64 years) residing in that precinct that month. We used a subset of the New York State Statewide Planning and Research Cooperative System (SPARCS) database to estimate rate numerators. The SPARCS database obtained by the project included diagnostic, procedural, demographic, home residence, and admission date information for all individuals admitted to community-based hospital facilities within NYC for treatment of an abscess, cellulitis, or endocarditis infection, regardless of aetiology, between 1995 and 1999. There were no marked changes in SPARCS data collection methods during the study period (oral communication, Gene Therriault, Executive Secretary, SPARCS Data Protection Review Board, November 1, 2000).

To identify cases of illicit-injection-related infections within this database, we constructed algorithms based on extant research using diagnostic, procedural, and patient age data (Ciccarone et al., 2001; Des Jarlais et al., 1999; DeWitt & Paaw, 1996; Joshi, Caputo, Weitecamp, & Karchner, 1991; Stone, Stone, & MacGregor, 1990; Straumann, Stutz, & Jenzer, 1990). Specifically, endocarditis cases were classified as illicit-injection-related if: (1) the patient was between 18 and 64 years old; and (2) either had endocarditis of the tricuspid or pulmonary valve, without prior predisposition to such infections, or had an accompanying illicit-drug-related co-diagnosis or procedure mentioned in their medical record. Cases of abscesses and cellulitis were classified as illicit-injection-related if (1) the patient was a non-diabetic individual between 18 and 64 years old; (2) the infection was not iatrogenic; and (3) either the infection occurred on the patient’s extremities, a documented frequent site of illicit-injection-related soft tissue infections (Ciccarone et al., 2001; Stone et al., 1990), or the patient had a drug-related co-diagnosis or procedure mentioned in his/her medical record. Because diagnostic codes for abscesses and cellulitis were identical, we treated them as a single outcome.

To locate each selected case within its home precinct, a professional geocoding firm, verified as having high geocoding accuracy (96%) (Krieger, Waterman, Lemieux, Zierler, & Hogan, 2001), first identified the longitude and latitude of each case’s home address and then located the corresponding point within an NYC police precinct. Of the 58,637 cases of illicit-injection-related infection identified using the algorithms described above, 7% (4199) cases could not be geocoded to a NYC precinct. The majority of these 4199 cases could not be geocoded because they either had an incomplete home address or gave a post office box as their home address. The addresses of less than 1% of the non-geocodable cases were listed as “homeless” or “undomiciled”. The geocoded sample included 48,806 cases of illicit-injection-related abscesses and cellulitis and 5452 cases of illicit-injection-related endocarditis.

Hospitalisation rate denominators (i.e., the number of individuals aged 18–64 years residing in each precinct during each month of the study period) were calculated with 1990 and 2000 Census block data, using methods identical to those used to calculate precinct population size described in Stage 2, above.

Stage 4: Hypothesis tests

Exploratory analyses of data for all 76 precincts were conducted to elucidate the distribution of the outcomes and each covariate. These exploratory analyses indicated an unanticipated citywide secular rise in hospitalisation rates for the study outcomes and seasonal variations in abscess and cellulitis hospitalisation rates, suggesting that our models should incorporate year and season as covariates.

To test this study hypothesis, we investigated the relationship of each covariate to each outcome in the 27 precincts that experienced a drug crackdown and modelled outcome rates over time in relation to the specified covariates using Poisson regression methods for longitudinal data, exploring possible interactions. Generalised estimating equation methods were used to control for within-precinct correlations over time (Diggle, Liang, & Zeger, 1994).
Stage 5: sensitivity analyses

We recognised that throughout the study period a proportion of the individuals harbouring the infections of interest would be incarcerated before they could seek inpatient care at a hospital facility reporting to SPARCS and that this proportion would have increased with the onset of the drug crackdown in each crackdown precinct. While incarcerated, these individuals might receive treatment for these infections that obviated the need for inpatient care in community-based hospitals reporting to SPARCS after their release, a supposition supported by research on the quality of care available within the criminal justice system (Farley et al., 2000; White et al., 2001). Accordingly, we attempted to acquire Riker’s Island inmate health data on the relevant infections from the New York City Health and Hospitals Corporation (HHC) for the time period of the crackdowns of interest. Access, however, was permitted only to the paper medical records and not to the computerised files; limited resources precluded this project from undertaking the manual medical record abstraction that would have been required to obtain the relevant data.

Given our inability to access relevant inmate health data, we used NYSDJCS data regarding the incarceration of people arrested in each precinct to conduct a sensitivity analysis assessing the impact of the incarceration of at-risk individuals on our results. Alcohol and drug use monitoring system data for New York County (Manhattan) suggests that approximately seven percent of individuals arrested in 1998 had injected cocaine and ten percent had injected heroin during the course of their lifetime (National Institute of Justice, 1999). Based on these data, we assumed that 15% of incarcerated individuals were recent injectors during the baseline period and 25% were recent injectors after each crackdown was implemented. Among these injectors, we assumed that between five and ten percent had an illicit-injection-related abscess or cellulitis infection requiring inpatient hospital treatment at incarceration and between one and five percent had illicit-injection-related endocarditis requiring inpatient hospital treatment at incarceration. Resulting estimates of these cases were then added to the monthly precinct-specific hospitalisation rate numerators and multivariate regressions conducted regarding the relationship of crackdown stages and hospitalisation rates.

Results

Analyses suggest that sociodemographic characteristics of the 27 crackdown precincts in the first month of the study period (January 1995) differed considerably from those of the 49 precincts that did not undergo a precinct-specific drug crackdown between 1995 and 1999. Crackdown precinct residents tended to be younger, more impoverished, and were less likely to be non-Hispanic white than residents of non-crackdown precincts (Table 1). During this baseline period, median hospitalisation rates for illicit-injection-related abscesses, cellulitis, and endocarditis within crackdown precincts were double or more than double those observed for non-crackdown precincts.

Bivariate analyses suggest that abscess and cellulitis infections followed a seasonal pattern, spiking during summer months (Table 2); endocarditis infections did not follow such a trend. Bivariate analyses also provide evidence of an underlying secular increase in infection rates within crackdown precincts, with abscess and cellulitis hospitalisation rates in

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>All precincts (N = 76)</th>
<th>Crackdown precincts (N = 27)</th>
<th>Non-crackdown precincts (N = 49)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Precinct population size (mean, standard deviation)</td>
<td>101,000 (48,000)</td>
<td>89,000 (40,000)</td>
<td>107,000 (51,000)</td>
</tr>
<tr>
<td>Precinct age structure (mean, standard deviation)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0–17 years</td>
<td>23.1% (7.8)</td>
<td>29.0% (5.6)</td>
<td>20.0% (6.9)</td>
</tr>
<tr>
<td>18–64 years</td>
<td>64.7% (6.7)</td>
<td>61.5% (4.3)</td>
<td>66.7% (7.2)</td>
</tr>
<tr>
<td>&gt;65 years</td>
<td>12.2% (4.0)</td>
<td>9.5% (2.3)</td>
<td>13.3% (3.8)</td>
</tr>
<tr>
<td>Percent of residents subsisting below the federal poverty line (mean, standard deviation)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21.8% (12.3)</td>
<td>33.0% (11.3)</td>
<td>15.6% (7.7)</td>
<td></td>
</tr>
<tr>
<td>Percent non-Hispanic white residents (mean, standard deviation)</td>
<td>38.2% (29.1)</td>
<td>12.0% (17.3)</td>
<td>52.6% (23.7)</td>
</tr>
</tbody>
</table>

Crude monthly hospitalisation rates for illicit-injection related infections (per 100,000)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>All precincts (N = 76)</th>
<th>Crackdown precincts (N = 27)</th>
<th>Non-crackdown precincts (N = 49)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abscess/cellulitis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (standard deviation)</td>
<td>22.9 (39.6)</td>
<td>24.4 (13.8)</td>
<td>22.0 (48.2)</td>
</tr>
<tr>
<td>Median (interquartile range)</td>
<td>13.4 (9.2–25.7)</td>
<td>20.8 (13.2–34.4)</td>
<td>11.0 (7.8–20.3)</td>
</tr>
<tr>
<td>Endocarditis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (standard deviation)</td>
<td>2.4 (2.9)</td>
<td>3.6 (2.4)</td>
<td>1.7 (2.9)</td>
</tr>
<tr>
<td>Median (interquartile range)</td>
<td>1.5 (0.0–4.2)</td>
<td>3.3 (2.0–5.5)</td>
<td>0.0 (0.0–2.0)</td>
</tr>
</tbody>
</table>

* Precinct sociodemographic profiles for January 1995 were interpolated using 1990 and 2000 US Census Neck and block group data for New York City assuming linear change over time.
Table 2
Crude and adjusted regressions of precinct characteristics, season, year, and crackdown stages on precinct-specific hospitalisation rates for illicit-injection-related abscesses, cellulitis, and endocarditis, among NYC’s 27 crackdown precincts, 1995–1999

<table>
<thead>
<tr>
<th>Covariates</th>
<th>Precincts with abscesses/cellulitis</th>
<th>Precincts with endocarditis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Crude relative risk (95% confidence interval)</td>
<td>Adjusted relative risk (95% confidence interval)</td>
</tr>
<tr>
<td></td>
<td>Crude relative risk (95% confidence interval)</td>
<td>Adjusted relative risk (95% confidence interval)</td>
</tr>
<tr>
<td>Season</td>
<td>0.75 (0.70–0.81)</td>
<td>0.76 (0.71–0.82)</td>
</tr>
<tr>
<td></td>
<td>0.87 (0.81–0.93)</td>
<td>0.87 (0.82–0.93)</td>
</tr>
<tr>
<td>Fall</td>
<td>0.84 (0.79–0.89)</td>
<td>0.86 (0.82–0.93)</td>
</tr>
<tr>
<td>Summer (referent)</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Percent residents living below poverty level</td>
<td>≥20% (1.54–2.29)</td>
<td>0.67 (0.41–1.09)</td>
</tr>
<tr>
<td></td>
<td>&lt;20% (referent)</td>
<td>1.00</td>
</tr>
<tr>
<td>Percent residents non-Hispanic white</td>
<td>0.99 (0.99–1.00)</td>
<td>0.99 (0.98–1.00)</td>
</tr>
<tr>
<td>Percent residents aged 18–64 years</td>
<td>0.94 (0.91–0.97)</td>
<td>0.96 (0.95–0.98)</td>
</tr>
<tr>
<td>Borough</td>
<td>Bronx</td>
<td>1.64 (1.21–2.22)</td>
</tr>
<tr>
<td></td>
<td>Brooklyn</td>
<td>2.46 (1.95–3.10)</td>
</tr>
<tr>
<td></td>
<td>Manhattan</td>
<td>1.53 (1.26–1.85)</td>
</tr>
<tr>
<td></td>
<td>Queens (referent)</td>
<td>1.00</td>
</tr>
<tr>
<td>Year</td>
<td>1995</td>
<td>0.63 (0.47–0.85)</td>
</tr>
<tr>
<td></td>
<td>1996</td>
<td>0.59 (0.44–0.78)</td>
</tr>
<tr>
<td></td>
<td>1997</td>
<td>0.55 (0.41–0.71)</td>
</tr>
<tr>
<td></td>
<td>1998</td>
<td>0.74 (0.59–0.93)</td>
</tr>
<tr>
<td></td>
<td>1999 (referent)</td>
<td>1.00</td>
</tr>
<tr>
<td>Crackdown stages</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Baseline (referent)</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>Preparation</td>
<td>0.96 (0.90–1.02)</td>
</tr>
<tr>
<td></td>
<td>Initiation month</td>
<td>0.99 (0.95–1.00)</td>
</tr>
<tr>
<td></td>
<td>First crackdown quarter</td>
<td>1.06 (0.98–1.15)</td>
</tr>
<tr>
<td></td>
<td>Second crackdown quarter</td>
<td>1.09 (0.99–1.22)</td>
</tr>
<tr>
<td></td>
<td>Third crackdown quarter</td>
<td>0.94 (0.87–1.02)</td>
</tr>
<tr>
<td></td>
<td>Fourth crackdown quarter</td>
<td>0.79 (0.71–0.87)</td>
</tr>
</tbody>
</table>

* 48,986 abscess and cellulitis cases and 5452 endocarditis cases aggregated to the precinct level.
* b “Crude” analyses can also be thought of as bivariate analyses.
* c “Adjusted” analyses included all variables listed in the table as model covariates.
* d No crackdowns occurred in Staten Island during the study period.
* e Crackdown stage definitions: Baseline: 4–15 months prior to crackdown initiation; Preparation: 1–3 months prior to crackdown initiation; Initiation month: month of crackdown initiation; Crackdown quarters: quarters following each crackdown’s initiation.

1999 substantially higher than in 1995 and endocarditis hospitalisation rates in 1999 substantially higher than in 1996. Rates of abscess, cellulitis, and endocarditis hospitalisations were approximately 1.8 times higher in precincts in which 20% or more of the population lived at or below the poverty line than elsewhere; the percentage of precinct residents aged 18–64 was inversely associated with hospitalisation rates for all infections studied. The percent of non-Hispanic whites residing in a precinct was inversely associated with endocarditis hospitalisation rates; while hospitalisation rates for abscess and cellulitis infections showed a similar trend, the trend did not reach statistical significance. Abscess, cellulitis, and endocarditis hospitalisation rates varied geographically, with rates higher in the boroughs of Brooklyn and Manhattan than in Queens.

Multivariate analyses based on infections among only the non-institutionalised population indicated that declines occurred in illicit-injection-related abscess, cellulitis, and endocarditis hospitalisation rates following the crackdowns’ onset, especially during the fourth quarter. Sensitivity analysis results (Table 3), however, suggest that hospitalisation rates for illicit-injection-related abscesses and cellulitis either declined only in the fourth crackdown quarter or remained static after the crackdowns’ onset, depending on whether we assumed that five or ten percent of incarcerated injectors were infected at incarceration. Hospitalisation rates for endocarditis remained static when we assumed that one percent of recently-incarcerated injectors were infected when incarcerated and increased during the first crackdown quarter when we assumed that five percent of
the criminal justice system. This scenario is consistent with
periods, and injectors who did not use drugs while incarcer-
repeat offenders were incarcerated for longer and longer
passing crackdown quarter as more injectors were arrested,
during the four quarters after each crackdown began. The
increase in
injection drug use declined in the 27 crackdown precincts
possible scenarios. First, it is possible that the prevalence of
static following the crackdowns’ initiation.
Our findings regarding the relationship of crackdown
precincts in NYC did not sup-
port our hypotheses that police drug crackdowns would be
associated with increases in precinct-specific hospitalisation
rates for illicit-injection-related abscesses, cellulitis, and en-
docarditis, and instead yielded evidence of a decline in these
rates for illicit-injection-related abscesses, cellulitis, and en-
docarditis hospitalisation rates; year and the percent
precinct age and racial/ethnic composition, season, year, and
borough remained statistically significant predictors of ab-
cess and cellulitis hospitalisation rates; year and the percent
of incarcerated individuals who were non-Hispanic white remained
significant predictors of endocarditis hospitalisation rates.
Discussion
Study results based on data for the non-institutionalised
these individuals were infected. In these multivariate models,
precinct age and racial/ethnic composition, season, year, and
borough remained statistically significant predictors of ab-
scess and cellulitis hospitalisation rates; year and the percent
of incarcerated individuals infected
5% of incarcerated individual
No incarcerated individual
individuals infected
individuals infected
individuals infected
individuals infected
individuals infected
No incarcerated individual
individuals infected
individuals infected
individuals infected
individuals infected
individuals infected
1% of incarcerated
individuals infected
individuals infected
individuals infected
individuals infected
individuals infected
No incarcerated individual
individuals infected
individuals infected
individuals infected
individuals infected
individuals infected
5% of incarcerated individual
No incarcerated individual
individuals infected
individuals infected
individuals infected
individuals infected
individuals infected
Table 3
Multivariate regression of crackdown stages on precinct-specific hospitalisation rates for illicit-injection-related abscesses, cellulitis, and endocarditis among
New York City’s 27 crackdown precincts, 1995–1999: with and without adjustments for incarceration of individuals harbouring infections a
Crackdown stage a
Hospitalisation rates for abscesses/cellulitis
Hospitalisation rates for endocarditis

<table>
<thead>
<tr>
<th>Crackdown stage</th>
<th>No incarcerated individuals infected relative risk</th>
<th>5% of incarcerated individuals infected relative risk</th>
<th>10% of incarcerated individuals infected relative risk</th>
<th>No incarcerated individuals infected relative risk</th>
<th>1% of incarcerated individuals infected relative risk</th>
<th>5% of incarcerated individuals infected relative risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline (referent)</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Preparation</td>
<td>0.94 (0.85–1.04)</td>
<td>0.95 (0.86–1.05)</td>
<td>0.96 (0.87–1.05)</td>
<td>1.21 (0.96–1.54)</td>
<td>1.21 (0.97–1.51)</td>
<td>1.19 (1.01–1.40)</td>
</tr>
<tr>
<td>Initiation month</td>
<td>0.89 (0.76–1.00)</td>
<td>0.91 (0.81–1.03)</td>
<td>0.93 (0.83–1.05)</td>
<td>0.96 (0.66–1.41)</td>
<td>1.01 (0.72–1.42)</td>
<td>1.11 (0.87–1.42)</td>
</tr>
<tr>
<td>First crackdown quarter</td>
<td>0.88 (0.77–1.00)</td>
<td>0.95 (0.83–1.08)</td>
<td>1.01 (0.89–1.14)</td>
<td>0.91 (0.66–1.25)</td>
<td>1.02 (0.77–1.36)</td>
<td>1.36 (1.10–1.69)</td>
</tr>
<tr>
<td>Second crackdown quarter</td>
<td>0.86 (0.74–0.99)</td>
<td>0.92 (0.79–1.06)</td>
<td>0.97 (0.84–1.12)</td>
<td>0.81 (0.62–1.06)</td>
<td>0.92 (0.71–1.18)</td>
<td>1.22 (0.99–1.50)</td>
</tr>
<tr>
<td>Third crackdown quarter</td>
<td>0.80 (0.67–0.94)</td>
<td>0.85 (0.72–1.01)</td>
<td>0.91 (0.77–1.07)</td>
<td>0.74 (0.53–1.05)</td>
<td>0.84 (0.62–1.15)</td>
<td>1.13 (0.88–1.44)</td>
</tr>
<tr>
<td>Fourth crackdown quarter</td>
<td>0.72 (0.57–0.91)</td>
<td>0.78 (0.62–0.97)</td>
<td>0.83 (0.67–1.03)</td>
<td>0.57 (0.35–0.92)</td>
<td>0.68 (0.45–1.03)</td>
<td>0.99 (0.73–1.35)</td>
</tr>
</tbody>
</table>

* Adjusting for year, season, precinct borough, precinct racial/ethnic and age composition, and precinct poverty status.

Crackdown stage definitions: Baseline: 4–15 months prior to crackdown initiation; Preparation: 1–3 months prior to crackdown initiation, Initiation month of crackdown initiation; Crackdown quarters: quarters following each crackdown’s initiation.

P < 0.05.

A corollary scenario is also possible: while the crack-
downs might have encouraged some injectors to stop or
reduce their injection drug use, other individuals might
have continued to inject drugs frequently and, in these
heavily-policed circumstances, might have engaged in
more unsafe injection practices during the crackdowns than
prior to the crackdowns’ onset. Such a scenario would be
consistent with the increasing declines in hospitalisation rates seen in each
subsequent crackdown quarter compared to baseline rates.
While the sensitivity analyses allowed for the possibility that
a proportion of recently-incarcerated individuals harboured
the infections of interest, they did not account for the transfer
of a substantial proportion of the at-risk population from the
police precinct to the criminal justice system.
Additionally, research regarding drug treatment initiation
suggests that entanglements with the criminal justice system
are treatment motivators (Shutz, Rapiti, Vlahov, & Anthony,
1994; Weatherburn & Lind, 2001). While research by Wood
and colleagues in Vancouver and Weatherburn and Lind
in Sydney found no relationship between crackdowns and
treatment admissions (Weatherburn & Lind, 1997; Wood et
al., 2004), the latter investigation was hampered by a lack of
variation in arrest rates and the former interviewed injectors
only 3 months after the crackdown’s onset. In contrast, the
present study focused on crackdowns that generated a 39%
increase in the median monthly drug-related arrest rate dur-
ing the year following the eight crackdowns’ initiation and
we followed precincts for 12 months after each crackdown’s onset.
Users’ resulting intensified involvement in the crim-
inal justice system, or heightened concern about impending
involvement, might have encouraged some to reduce the frequency with which they injected, switch to non-injection
modes of administration, or abstain from drug use altogether.

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the crackdown and consequent adverse health effects (Best et al., 2001;

crackdown's onset, thus perhaps minimising their fear of ar-

have started using drugs in non-crackdown precincts after the

water and other materials needed for safe injection is lim-

vate spaces than in public spaces, where access to running

sation rates after the crackdowns' onset might partially be an

As Wood and colleagues, Curtis, and others have found, intensified drug-related policing activities can displace drug activity to new areas (Best, Strang, Beswick, & Gossop, 2001; Cooper et al., in press; Curtis, 2003; Wood et al., 2003; Wood et al., 2004). Three forms of displacement are pos-

possible, each of which may have exerted a different effect on rates of injection-related harms in crackdown precincts. First, injectors with access to private space may have shifted their drug use from parks and alleyways to private spaces within crackdown precincts to avoid police attention (Cooper et al., in press; Curtis, 2003). These injectors may have been bet-

ter able to reduce the harm of their drug use in these pri-

or stasis in hospitalisation rates for illicit-injection-related infections after the crackdowns began and also with all past research on fear of arrest and injection practices among active injectors (Aitken et al., 2002; Bluthenthal, Kril et al., 1999; Bluthenthal et al., 1997; Bluthenthal, Lorvick, et al., 1999; Bluthenthal & Watters, 1995; Bourgois, Lettieri, & Quesada, 1997; Cooper et al., in press; Grund, Heckathorn, & Anthony, 1995; Koester, 1994; Maher & Dixon, 1999; Zule, 1992). Given that our study contained no individual-level data with which to provide insight into individual drug use practices, however, we could not test this scenario's validity.

As stated earlier, we lacked access to HHC's inmate health data and thus used sensitivity analyses to investigate the ef-

fect on our analyses of excluding individuals who, had they

not been incarcerated, would have remained eligible to be included in the SPARCS data for the non-institutionalised population. The elevated arrest rates found here following the crackdowns’ onset testify to the importance of taking the possible prison-based treatment of the infections of interest into account in the analyses, as does research suggesting that the quality of healthcare services provided within the crimi-

nal justice system may be similar or superior to that available

in the community (Farley et al., 2000; White et al., 2001). Given the lack of actual data on infection rates among newly incarcerated individuals, however, our sensitivity analyses might have underestimated, or less plausibly, overestimated, the number of recently-incarcerated individuals harbouring the infections of interest.

Finally, unanticipated temporal trends in injection drug use, HIV/AIDS, and the incidence of hospitalisations for illicit-injection-related infections during the study period might have impeded our ability to detect crackdown-related changes in the outcomes. The number of injectors, and possibly those at particular risk of developing the outcomes, declined markedly citywide during the course of the study period. Research conducted by Friedman and colleagues and Holmberg suggests that the number of past-year injectors residing in the NYC metropolitan area declined by approximately 35% during the study period, from 197/10,000 residents in 1993 to 125/10,000 residents in 1998 (Friedman et al., 2004; Holmberg, 1993). Additionally, HIV incidence among injectors in NYC declined and highly active anti-retroviral therapy (HAART) emerged during the study period (Don Des Jarlais, Marmor, et al., 2000; Don Des Jarlais, Perlis, et al., 2000). Given that injectors with HIV, and perhaps in particular those with lower CD4 cell counts, are more susceptible to the infections studied than other injectors (Spijker, van Ameijden, Mientjes, Coutinho, & van den Hoek, 1997; Wilson, Thomas, Astemborski, Freedman, & Vlahov, 2002), these epidemiologic developments might have reduced the population at heightened risk of the study’s outcomes during the study period. We were unable to incorporate these substantial reductions in the population at risk for illicit-injection-related infections in our statistical models; this limitation might have impaired our ability to compare trends in pre- and post-crackdown initiation hospitalisation rates, since we were analysing rates in relation to the total population in each precinct because no data exist on the size of the at-risk population (i.e., current injectors) in each precinct.

Similarly, the unanticipated citywide temporal increase in illicit-injection-related infections during the study period
could have eclipsed any rise due solely to the crackdowns. This increase is of interest, particularly in a context of declining numbers of injection drug users in NYC. A contributing factor might be that injectors in NYC greatly increased their participation in syringe exchange programs during these years (Des Jarlais, Marmor, et al., 2000; Des Jarlais, Perlis, et al., 2000) and these programs may have linked injectors to hospital-based care for their infections. Research suggests that the rise in abscesses, cellulitis, and endocarditis found in NYC might not be a local phenomenon: a similar increase in hospitalisations for soft tissue infections occurred in San Francisco during the study period (Ciccarone et al., 2001).

Similar to actions taken in San Francisco (Ciccarone et al., 2001), it may be useful in NYC for community clinicians, staff at programs serving injectors, epidemiologists, and active injectors to convene a task force to establish a research program to identify the causes of the increase in illicit-injection-related infections and formulate methods to address it. Given the morbidity and mortality associated with these infections, and the cost of treating them (charges for inpatient treatment of 945 individuals for soft tissue infections, the majority of which were injection-related, in one San Francisco hospital reached approximately (US) $9.9 million per fiscal year 1996–2000 (Ciccarone et al., 2001), such a task force should consider systematically monitoring patterns of hospitalisation for illicit-injection-related abscess, cellulitis, and endocarditis infections.

Study results suggest that further research into the effects of particular police strategies on injectors’ health is warranted. A useful line of inquiry lies in discerning which of the proposed scenarios described above, or which combination of these scenarios, is correct. Multi-level investigations examining the relationship between crackdowns and injectors’ health might be fruitful if they constructed the outcome as self-reported instances of illicit-injection-related infections and incorporated individual-level data regarding police encounters, injection drug use frequency and cessation, and injection practices and precinct-level data concerning the crackdown status of each participants’ home precinct and the precinct’s sociodemographic profile. Additionally, as evidenced here by the elevated arrest rates following the crackdowns’ onset, future investigations should include information regarding inmate health status, acquired through processes that respect inmates’ human rights. Such research, coupled with past investigations into the relationship between arrest concerns and unsafe injection practices, could inform policy-makers entrusted with selecting drug-related law enforcement approaches about the possible unintended health consequences of the strategies under consideration.

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