Homelessness and HIV Risk Behaviors among Injection Drug Users

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ABSTRACT   *This article uses data from an 8-year study of injection drug users to examine whether homelessness independently influenced the likelihood of engaging in human immunodeficiency virus (HIV) risk behaviors. Fixed effects regression analyses are used to estimate the associations between four different housing contexts and four different behaviors related to transmitting HIV infections. Results showed that 16% of the study group experienced homelessness at some point during the study, and that homelessness was significantly associated with a higher likelihood of frequenting shooting galleries (odds ratio=2.05), but did not have a significant effect on sharing syringes, sharing other injection drug paraphernalia, or participating in paid sex. These results provide limited support for positing homelessness as independently associated with increased levels of HIV-related risk behavior among injection drug users and highlights the need for more research that examines the housing dynamics among this population.*

KEYWORDS   *AIDS, HIV risk behavior, Homelessness, Injection drug use.*

INTRODUCTION

Injection drug users (IDUs) are among the groups at highest risk for contracting human immunodeficiency virus (HIV) infection, with much of this risk coming from behaviors related to injection drug use and sexual activity. This article examines the relationship between housing status and engaging in HIV risk factors among a group of IDUs over the course of their participation in an 8-year study.

Substandard housing has been identified as a major public health issue,[1] with homelessness as a key social factor that facilitates risk behaviors and health differentials among drug users.[2] The precarious and impoverished existence brought on by homelessness creates a context in which an individual is confronted with scarce material resources, social isolation, inadequate access to health care and other services, and circumstances that make it difficult to maintain basic hygienic practices. As such, homelessness increases the likelihood for engaging in a variety of health risks, including sexual and drug-related behaviors that enable the transmission of HIV. This presentation of homelessness as a social environment that facilitates risk behaviors is illustrated in the Figure, which presents a model reproduced from the work of Galea and Vlahov.[2] The relationship between homelessness and risk behavior, as presented in the Figure, was empirically tested in this study.

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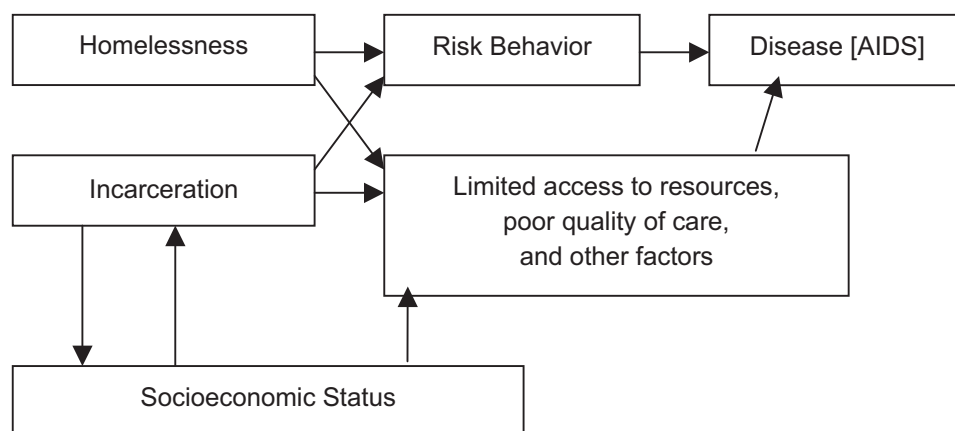
FIGURE. Conceptual model of the relationships among socioeconomic status, homelessness, and incarceration and the health of illicit drug users. (Reprinted from Ref. 2, p. 137.)

Numerous studies have found elevated prevalence rates of HIV/AIDS (acquired immunodeficiency syndrome) in homeless populations,[3–7] and substance abuse, particularly injection drug use, was repeatedly identified as a characteristic associated with a higher likelihood of HIV infection among homeless populations.[8–11] High degrees of both HIV infection and HIV-related risk behaviors among the homeless population have showcased homeless settings as key targets for HIV services that provide care and prevent further transmission of the virus.[3–6,12]

Fewer studies looked at these outcomes among samples of IDUs that included both homeless and nonhomeless persons, designs that permit assessing whether homelessness itself is a risk factor related to HIV infection and related risk behaviors. Smereck and Hockman[13] find that on-the-street homeless persons in a sample of drug injectors and cocaine smokers had a 19% rate of HIV infection, which was significantly higher than the 11.2% rate of the study population as a whole (including sheltered and other persons who were unstably housed but not living on the streets). Similarly, Patrick et al.[14] found that "unstable housing" was independently related to HIV seroconversion (odds ratio [OR] 2.0) among a group of IDUs in Vancouver, and Siegal et al.[15] found shelter use was independently related to HIV infection (OR 7.7) among a group of IDUs recruited in low-seroprevalence areas in the Midwest.

Two other studies used methods that addressed shortcomings found in this body of research and thus merit additional attention. Andia et al.,[16] examining risk behaviors associated with residential status among Puerto Rican IDUs in Puerto Rico and New York City, classified five different types of residential status: homelessness, living with parents, living with others, living in temporary housing such as a hotel, and living in one's own home. Such a taxonomy enables the comparison of homelessness with stable housing (rather than all other types of housing); maintains homelessness as a discrete category; and allows for the possibility that dynamics associated with other types of housing may also have an impact on risk behaviors. Andia et al. also examined four specific types of risk behaviors. Such specificity led to findings that reported homelessness, although not significantly associated with sharing syringes, nonetheless was associated with greater probabilities of sharing other paraphernalia, using shooting galleries, and engaging in paid sex (either giving or receiving money for sex).

Despite this more nuanced treatment of housing and risk behavior, Andia et al.'s study shared with the other studies reviewed so far the disadvantages inherent in using cross-sectional data to examine a phenomenon as dynamic as homelessness. Far from being a static attribute, homelessness is more like a fluid state from which persons typically drift in and out and for which 2.5 to 10 times as many persons stay in shelters over the course of a year than the number staying there at a given point in time.[17] Cross-sectional studies are likely to underestimate the prevalence of homelessness because of their use of point-in-time measures.[18] Furthermore, given that homelessness is not an unusual occurrence among certain demographic groups among the urban poor,[19] cross-sectional studies risk confounding cases with controls as the group identified as homeless in these studies may, at some other time, be considered housed, and a number of the controls might then be homeless.

Song et al.[18] used longitudinal data to examine the relationship among homelessness, drug use, and HIV infection. The study defined a subject as homeless if he or she experienced an episode of homelessness at some point during the 10-year study period. As a result, 46.7% of the study sample of Baltimore, Maryland, IDUs were homeless at some point over the study period compared to 11.0% of this sample at baseline. The study, however, used person-level data to examine independent factors associated with homelessness among this sample of IDUs. In doing so, it still treated homelessness as a trait as opposed to a state[20] and failed to take into account variation among individuals over time in housing status or drug use. The study also did not consider specifically the relationship of HIV risk factors to homelessness, which is the most proximal link in any more general relationship between homelessness and HIV/AIDS.

This study was similar in key respects to those of Andia et al.[16] and Song et al.[18] in that it used the advantages of longitudinal data to examine the relationship between different housing statuses and specific HIV risk behaviors. This study, however, treated both housing status and risk behaviors as phenomena with occurrences that vary not only across IDUs, but also among individual IDUs over time. As a result, this study was able to hypothesize that HIV risk behaviors are more likely to occur when an individual experiences homelessness regardless of any specific characteristics among the different individuals. Homelessness thereby was cast as a social factor that had an independent effect on risk behaviors, consistent with how it was depicted in Galea and Vlahov's model.[2]

DATA AND METHODS

Data reported here were collected by the Risk Assessment Project (RAP), a longitudinal study of HIV risk behaviors and HIV seroincidence. The RAP project began in 1989 with the enrollment of 255 individuals who had injected drugs at least once in the prior year. An additional 160 IDUs were added to the cohort in 1993. Recruitment started in a single, large methadone treatment program located in North Philadelphia, Pennsylvania. All subjects enrolled from the methadone treatment program (N=152) were randomly selected from a list of volunteers who had agreed to be part of the study. All subjects completed informed consent procedures prior to being assessed. Those subjects who were enrolled were asked to refer people (by asking them to call or stop by the research office) they knew who were also injecting drugs but not currently in treatment. This resulted in the enrollment of 103 subjects who had not been in treatment for at least 10 months prior to enrollment. For the second cohort, 160 subjects were enrolled using the same selection procedures and program

site. Follow-up interviews were conducted semiannually until 1996. During these interviews, behavioral and serological assessments were conducted, and the data collected included information on subjects' demographics, HIV status, HIV-related risk behaviors, drug use and treatment history, and sexual activity. In all, 415 subjects were interviewed.

These data were merged with data from the Philadelphia Office of Emergency Shelter Services (OESS). OESS directly administers or provides operating support for approximately 85% of Philadelphia homeless shelter beds and maintains a centralized database that contains information on the individuals utilizing shelter services and the amount of services used. Data from RAP and OESS were matched on the basis of common name, social security number, date of birth, and gender. When a match between the two data sets was ascertained, data on shelter utilization was added to the individual's RAP record. This data on shelter use supplemented self-reported information on homelessness in the RAP database.

The key variables in this data set related to housing status and risk behaviors. For housing status, study participants indicated for each survey wave whether they lived in a house or apartment; in a halfway house or other similar congregate facility; in temporary housing arrangements, such as hotels or rented rooms, for which they paid rent daily or weekly; other, unspecified housing arrangements; or whether they were homeless during that wave. *Homeless* was defined as living on the streets or in a shelter and was assessed based on either self-report or OESS records. A participant was considered homeless in the wave regardless of whether he or she also had other types of living arrangements during that survey wave. All other response types assumed that the type of housing indicated referred to the primary type of housing during this period. The category "other housing situation" was used when the interviewer felt a housing situation did not fit the other categories. There is no information from the RAP survey on household composition, on the amount of payment the respondent made for housing, or on whether the respondent was staying in someone else's (e.g., family or friend) household.

Four measures of risk behavior were used in this study. The first was whether study participants reported sharing syringes with anyone else, either with someone else using the participant's syringe or the participant using someone else's syringe. In a similar fashion, the second measure was whether study participants reported sharing other paraphernalia used to inject drugs: cotton, rinse water, and cookers. The third measure reflected whether study participants reported frequenting "shooting galleries" to buy or use drugs. The final measure was whether the study participant engaged in sex that involved the exchange of money. As reported in the work of Andia et al.,[16] the first two measures have been widely identified as HIV transmission routes and the last two as circumstances in which behavior is likely to occur that enables HIV transmission.

After reporting descriptive statistics and assessing bivariate differences among risk behaviors according to housing status, multivariate logistic regression was used to test for independent relationships between dichotomous measures of risk behavior and housing status, controlling for all stable characteristics associated with the persons in the study group, as well as a set of factors that were time variant. This was done using conditional likelihood estimation, which, in constructing the likelihood functions for the outcome measures, considered the variability within the multiple observations recorded for each individual for the dichotomous outcome variable.[21] The resulting model generated odds ratios and *P* values for time-varying coefficients while implicitly controlling for all time invariant factors. Results using this fixed-effects estimation

method were obtained using PROC PHREG in SAS statistical software (SAS Institute, Cary, NC).

Along with the aforementioned set of covariates measuring housing status, the model also included various other time-variant covariates. These included measures in each survey wave for a person's HIV status; drug use (heroin, cocaine, or heroin/cocaine "speedball" injection; "crack" cocaine smoking; and alcohol use); participation in methadone treatment, detoxification, or other drug treatment; and whether a person was employed, in jail, and married.

RESULTS

Of the 415 participants in the RAP project, 14 were not used in this analysis because they participated for less than two survey waves. The 401 remaining persons were each surveyed approximately every 6 months and generated 4,904 observations. Table 1 shows selected characteristics of the study group by person and observation. The study group was predominantly male and in their 30s and 40s. Blacks were disproportionately represented, but a substantial minority of the group was white; Hispanics were only 6% of the study group, which is consistent with the small proportion they comprise in the overall Philadelphia population.

Almost everyone in the study (96%) lived in an apartment or house at some point during the study. Although only 3.9% of the observations included a homeless episode, 16% of the study group experienced homelessness at some point during their RAP participation. These two contrasting measures corresponded to point-prevalent and longitudinal assessments of homelessness, respectively. Looking more closely at this juxtaposition showed that, among the 64 persons who experienced a homeless episode, just under two thirds (n=42) experienced homelessness in one (n=24), two (n=13), or three (n=5) waves. Among the remaining housing categories, "other housing situation" was reported more frequently (5.2% of the observations) and by a higher proportion of the study participants (29.2%) than homelessness. Finally, halfway house stays comprised only 0.7% of the observations and included only 6.0% of the participants.

As would be expected with this study group, large proportions reported injecting heroin (74.6%), cocaine (61.4%), and the combination heroin-cocaine speedball (69.8%). The substantially lower proportions of observations in which these drugs were reported to be injected also suggested, however, that many in the group reported periods of abstinence from intravenous drug use. Crack cocaine use and alcohol use were also both commonplace among the study group. The proportions of the study group engaging in each of the four respective risk behaviors were also high, ranging from approximately one third to two thirds of the study population. Almost three quarters of the group (71.8%) participated in methadone treatment, 36.2% underwent detoxification treatment, and 22.9% had some other type of treatment at some point during their study participation. Almost one quarter (23.4%) were HIV positive at some point during the study, with 22 of these 94 HIV-positive participants (23.4%) seroconverting at some point during the course of the study.

"Year of last interview," indicating the last year for which data were collected on each participant, was a measure of attrition. Just under 30% of the study group did not participate through the end of the study. Not surprisingly, the proportion of total observations corresponding to this group, 18.8%, is smaller than their proportion of the study group. The limited data that were collected on the circumstances

TABLE 1. Characteristics related to demographic, residential, drug use, and other factors of Risk Assessment Project study participants, by person and survey wave observations

	Persons (n = 401)	Observations (n = 4,904)
Male	300 (74.8%)	3,617 (73.8%)
Age (at enrollment), years		
18–29	26 (6.5)	316 (6.4)
30–39	161 (40.2)	2,181 (44.5)
40–54	148 (36.9)	1,898 (38.7)
55+	10 (2.5)	163 (3.3)
Missing	56 (14.0)	346 (7.1)
Race/ethnicity		
Black (non-Hispanic)	259 (64.6)	3,139 (64.0)
White (non-Hispanic)	114 (28.4)	1,444 (29.5)
Hispanic	24 (6.0)	267 (5.4)
Other	4 (1.0)	54 (1.1)
Housing status		
House or apartment	385 (96.0%)	3,865 (78.8%)
Halfway house	24 (6.0%)	32 (0.7%)
Temporary housing	161 (40.2%)	554 (11.3%)
Other housing situation	117 (29.2%)	263 (5.4%)
Homeless	64 (16.0%)	190 (3.9%)
Risk behaviors		
Syringe sharing	174 (43.4%)	662 (13.5%)
Sharing other paraphernalia	258 (64.3%)	1,254 (25.6%)
Gallery use	196 (48.9%)	794 (16.2%)
Paid sex	132 (32.9%)	434 (8.9%)
HIV/AIDS	94 (23.4%)	745 (15.2%)
Drug use		
Injected heroin	299 (74.6%)	2,036 (41.5%)
Injected cocaine	246 (61.4%)	1,116 (22.8%)
Injected heroin/cocaine (speedball)	280 (69.8%)	1,371 (23.0%)
Smoked cocaine	186 (46.4%)	927 (18.9%)
Drank alcohol	330 (82.3%)	2,497 (50.9%)
Treatment		
Methadone	288 (71.8%)	1,536 (31.3%)
Detoxification	145 (36.2%)	228 (4.7%)
Other treatment	92 (22.9%)	200 (4.1%)
Other indicators		
Worked	192 (47.9%)	897 (18.3%)
Incarcerated	132 (32.9%)	408 (8.3%)
Married	151 (37.7%)	961 (19.6%)
Year of last interview		
Before 1996	120 (29.9%)	922 (18.8%)
1996	281 (70.1%)	3,982 (81.2%)
Death within 6 months after interview	55 (13.7%)	365 (7.4%)

related to the termination of participation in the study indicated that 45.8% of those dropping out of the study (13.7% of the total study group) died within 6 months after completing (what turned out to be) their final interview.

Table 2 shows the distributions of survey wave observations involving the risk behaviors as grouped by the different categories of residential status. Among the residential categories, the one with the highest frequency, proportionally, of all four types of risk behavior was homelessness, and the house or apartment category had the lowest incidence for three of the four risk behaviors. Especially for shooting gallery use, the homelessness category had a much higher incidence rate than the other housing categories. For all four risk behaviors, χ^2 tests indicated that the differences among housing categories were significant at the $P < .001$ level.

The measures in Tables 1 and 2 are presented in multivariate fixed-effects logistic regression models in Table 3. Fixed-effects control for all invariant characteristics of the study subjects and, except for the housing status covariates, the other covariates in the model served primarily as additional controls. Furthermore, a set of 19 dummy variables controlling for the survey wave in which the observation occurred was also part of the model, but is not presented on Table 3. Among the housing status covariates, homeless was significantly different from house/apartment (the reference category) only for shooting gallery use, for which an observation containing a positive homelessness indicator was 2.05 times more likely to go to a shooting gallery than an observation for which the study participant was living in a house or apartment, all other things held constant.

Despite the differences noted in Table 2, homelessness was not significantly associated with any of the other risk behaviors than the other types of residential status. The only other housing status category with significant associations to risk behaviors was other housing, which was significantly associated with higher likelihoods of syringe sharing (OR 3.22) and shooting gallery use (OR 1.91).

Among the other covariates, the three types of injection drug use and crack cocaine use were all significantly associated with higher likelihoods of syringe sharing, other paraphernalia sharing, and shooting gallery use. In the paid sex model, the cocaine use covariates both were associated with significant, increased odds ratios; heroin use was nonsignificant. Other significant effects included findings that HIV-positive status, detoxification treatment, and jail time were all associated with lower, higher, and higher probabilities of syringe sharing, respectively, and that alcohol

TABLE 2. Housing characteristics by risk behaviors

	All observations	Syringe sharing	sharing other paraphernalia	Shooting gallery use	Paid sex
Total observations (n = 4,904)	4,904 (100%)	662 (13.5%)	1,254 (25.6%)	794 (16.2%)	434 (8.9%)
House or apartment	3,865 (100%)	480 (12.0%)	930 (24.1%)	527 (13.6%)	270 (7.0%)
Halfway house	32 (100%)	5 (15.6%)	10 (31.3%)	7 (21.9%)	5 (15.6%)
Temporary housing	554 (100%)	89 (16.1%)	189 (34.1%)	153 (27.6%)	96 (17.3%)
Other housing situation	263 (100%)	51 (19.4%)	53 (20.2%)	33 (12.6%)	21 (8.0%)
Homeless	190 (100%)	37 (19.5%)	72 (37.9%)	74 (39.0%)	42 (22.1%)
χ^2	20.7	45.6	147.8	109.5	
Degrees of freedom	4	4	4	4	
P	<.001	<.001	<.001	<.001	

TABLE 3. Fixed-effects logistic regression models estimating independent associations of covariates (including residential status) on four dichotomous measures of HIV-related risk behavior among injection drug users in Philadelphia, Pennsylvania, 1989–1997

	Syringe sharing			Sharing other paraphernalia			Gallery use			Paid sex		
	OR	CI	P	OR	CI	P	OR	CI	P	OR	CI	P
Homeless	0.92	(0.42–2.02)	.84	1.61	(0.85–3.07)	0.15	2.05	(1.11–3.78)	.02	1.49	(0.78–2.82)	.23
Halfway house	0.54	(0.11–2.67)	.45	1.31	(0.37–4.71)	.68	3.35	(0.63–17.9)	.16	4.57	(0.89–23.4)	.07
Temporary housing	1.22	(0.74–2.02)	.44	0.96	(0.63–1.46)	.86	1.13	(0.74–1.73)	.58	1.32	(0.82–2.13)	.25
Other housing situation	3.22	(1.70–6.07)	.00	1.37	(0.76–2.45)	.29	1.91	(1.05–3.48)	.03	0.90	(0.43–1.85)	.77
House or apartment	(Reference category)			(Reference category)			(Reference category)			(Reference category)		
HIV infected	0.17	(0.04–0.67)	.01	0.68	(0.25–1.87)	.45	1.15	(0.44–3.02)	.77	0.74	(0.25–2.14)	.58
Injected heroin	2.78	(1.89–4.09)	.00	3.44	(2.55–4.62)	.00	2.97	(2.07–4.25)	.00	1.23	(0.78–1.94)	.37
Injected cocaine	2.64	(1.75–3.96)	.00	2.49	(1.80–3.45)	.00	2.25	(1.56–3.25)	.00	2.04	(1.27–3.27)	.00
Smoked crack cocaine	2.17	(1.38–3.40)	.00	2.17	(1.51–3.10)	.00	1.57	(1.06–2.32)	.03	2.00	(1.29–3.10)	.00
Injected speedball	2.17	(1.45–3.25)	.00	2.29	(1.67–3.13)	.00	2.51	(1.74–3.60)	.00	0.81	(0.51–1.29)	.37
Alcohol use	1.11	(0.74–1.65)	.61	1.33	(0.97–1.82)	.08	1.69	(1.18–2.41)	.00	1.75	(1.13–2.72)	.01
Methadone treatment	0.80	(0.53–1.23)	.31	0.88	(0.62–1.24)	.46	0.91	(0.61–1.34)	.63	0.73	(0.45–1.18)	.20
Detoxification	2.49	(1.41–4.39)	.00	1.44	(0.89–2.34)	.14	0.79	(0.48–1.32)	.37	0.83	(0.46–1.52)	.55
Other drug treatment	0.65	(0.30–1.42)	.28	0.77	(0.39–1.51)	.45	1.20	(0.61–2.37)	.60	0.74	(0.37–1.50)	.40
Employed	0.62	(0.38–1.00)	.05	0.82	(0.55–1.21)	.32	0.78	(0.51–1.20)	.26	1.20	(0.74–1.92)	.46
In jail	1.77	(1.06–2.95)	.03	0.85	(0.54–1.35)	.49	0.83	(0.51–1.35)	.46	1.29	(0.76–2.18)	.35
Married	0.70	(0.39–1.26)	.23	0.64	(0.41–1.00)	.05	0.75	(0.43–1.31)	.31	0.67	(0.35–1.29)	.23

CI, 95% confidence interval; OR, odds ratio.
Not included in the table are a set of 19 dichotomous variables controlling for survey wave in which each observation occurred.

use was associated with a higher likelihood of both shooting gallery attendance and engaging in paid sex. Also notable are some of the nonsignificant results, such as the lack of effect of methadone treatment on any of the risk factors. Finally, 19 dichotomous variables were also included in the model to control for possible effects of time, but their effects are not included in Table 3. Replacing this set of dichotomous variables with a single continuous variable did not substantially alter the effects of the covariates of interest.

DISCUSSION

The results presented here give limited support for the portion of Galea and Vlahov's conceptual model that has homelessness associated with increased levels of HIV-related risk behavior (Figure). Because the results were derived from panel data and fixed-effects regression models, they reflect the effects of homelessness after controlling for individual characteristics of the study participants. Although there were elevated levels of risk behaviors that occurred during the periods in which the RAP participants experienced homelessness, multivariate analyses showed significant associations only between homelessness and one of the four risk factors examined here: shooting gallery use.

The use of shooting galleries, sites featuring the sale and congregate use of injectable drugs, is more prominent when residential status is unstable. As most heroin injection occurs within the user's place of residence,[22] shooting galleries would stand in as surrogate locations to use drugs. Such pragmatic use of shooting galleries can be seen not only as more likely in a situation marked by economic and residential instability[23], but also its social and economic milieu create circumstances in which HIV transmission behaviors are more likely to occur, as well as risks for other undesirable health outcomes.[24,25]

Although shooting galleries may be places that facilitate specific HIV transmission behaviors, independent associations between homelessness and three other risk factors (syringe sharing, sharing of other paraphernalia, and exchanging sex for money) were not found in this analysis. These nonsignificant findings were contrary to this study's hypotheses and findings from Andia et al., whose analysis of point prevalent data found significant independent associations between homelessness and not only gallery use, but also sharing other paraphernalia and paid sex.[16] The inability of this study to replicate all of Andia et al.'s findings, however, may be because of issues surrounding the measure of homelessness in the RAP data. The RAP data, unlike the data used by Andia et al., did not differentiate between whether the study participant was the primary occupant of the residence (i.e., paying for the residence) and whether the participant was staying in someone else's home. This is a crucial distinction in determining the degree of residential stability.

An additional issue is the prevalence of homelessness in different studies of IDUs. In two studies that looked at the prevalence of homelessness among IDUs, Andia et al. reported a 4.3% point prevalence rate that is slightly higher than the 3.9% rate found here.[16] In contrast, the proportion of RAP participants reporting homelessness over the course of the study, 16.0%, is considerably lower than the 46.7% rate found by Song et al.[18] over the course of a 10-year study of IDUs in Baltimore. Although some of this difference was caused by the longer duration of the Baltimore study, factors such as participant selection and survey protocol can also influence the reported levels of homelessness. A large proportion of the RAP

participants was recruited from methadone clinics, a characteristic that may be indicative of greater economic and residential stability. Furthermore, a look at the consistency between self-reports of homelessness from the RAP data and shelter use from the OESS data showed that, among the 190 observations in which homelessness was reported, only 36 (19%) showed homelessness from both OESS records and self-report. This means that, in 91 observations (47.9%), respondents spent time in shelters but did not report this in the RAP survey, and in 63 (33.2%) observations, the respondents reported homelessness but did not have corresponding OESS records. This can be caused by homelessness spent on the streets and in other nonshelter locations or inconsistencies in identifying data that precluded data matching. This means that each of these two data sources, by themselves, would have missed a substantial amount of the homelessness found in the study group, and it is uncertain how much additional homelessness was missed in the available data.

Another related limitation is the relative preponderance of the "other housing situation" category among housing measures. It is not possible to determine further details on the nature of these housing situations, although it is likely that at least some involved unconventional and unstable arrangements that may resemble and overlap conceptually with what can be considered "homeless" circumstances. It is unfortunate that further details are not available because this category showed significant associations with both shooting gallery use (on a magnitude similar to homelessness) and syringe sharing. This last effect (OR 3.22) is particularly strong.

Finally, as Table 1 showed, there was a substantial degree of attrition. Although considerable effort was made to maintain contact with what is a notoriously difficult population to follow, almost one third of the study group were not participating in the study when the final survey wave was completed in 1996. Much of this was unavoidable because almost half of those who dropped out died before they were due to be interviewed again. The attrition group also showed significantly both a higher prevalence of HIV-positive status (32.5% to 19.6%) and instances of experiencing other housing situations (7.2% to 5.0%). However, the group also had significantly lower proportions of observations reporting heroin and crack cocaine use and sharing other paraphernalia (i.e., other than syringes) and had significantly higher proportions of observations involving episodes of all three categories of treatment as well as employment. This last group of findings supports anecdotal reports by interviewers that some persons stopped their participation in the RAP study as part of their attempt to exit the drug-using milieu.

In conclusion, the uncertainties in the data, particularly those related to the measures of housing and homelessness, potentially blur the distinctions between homelessness and stable housing among the survey participants and may contribute to the lack of associations found between homelessness and three of the four risk factors. This underscores the need for more research focusing specifically on the living arrangements that accompany injection drug use among indigent populations; the degree to which homelessness, as it is conventionally measured, provides an adequate measure of residential instability among IDUs; and further analyses on the associations of residential instability with risk behaviors for undesirable health outcomes. Taking such an approach, with homelessness (and other manifestations of residential instability) cast as a social factor and assessing whether it is directly related to undesirable health outcomes, is important to efforts to document the public health ramifications posed by homelessness.

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