Research paper

Activity spaces among injection drug users in San Francisco

Alexis N. Martinez a,∗, Jennifer Lorvick b, Alex H. Kral b

a Department of Sociology, San Francisco State University, United States
b Urban Health Program, RTI International, San Francisco, CA, United States

A R T I C L E   I N F O

Article history:
Received 18 May 2013
Received in revised form 7 November 2013
Accepted 13 November 2013

Keywords:
Activity spaces
Geographic mobility
HIV
Overdose
Syringe sharing
Injection drug use
San Francisco
GIS

A B S T R A C T

Background: Representations of activity spaces, defined as the local areas within which people move or travel in the course of their daily activities, are unexplored among injection drug users (IDUs). The purpose of this paper is to use an activity space framework to study place and drug user health.

Methods: Data for this analysis is from an epidemiological study of street-recruited IDUs in San Francisco (N = 1084). Study participants reported geographic intersections of where they most often slept at night, hung out during the day, and used drugs during a 6 month time period. We used GIS software to construct and map activity space routes of street-based network paths between these intersections. We further identified if syringe exchange program (SEP) locations intersected with, participant activity space routes. We used logistic regression to estimate associations between activity space variables and HIV serostatus, syringe sharing, and non-fatal overdose, after adjusting for individual and Census tract covariates.

Results: Mean activity space distance for all participants was 1.5 miles. 9.6% of participants had a SEP located along their activity space. An increase in activity space distance was associated with a decrease in odds of being HIV positive. An increase in residential transience, or the number of different locations slept in by participants in a 6 month time period, was associated with higher odds of syringe sharing. Activity space distance was not independently associated with overdose or syringe sharing.

Discussion: Research that locates individuals in places of perceived importance is needed to inform placement and accessibility of HIV and overdose prevention programs. More attention needs to be given to the logistics of collecting sensitive geospatial data from vulnerable populations as well as how to maximize the use of GIS software for visualizing and understanding how IDUs interact with their environment.

© 2013 Published by Elsevier B.V.

Background

Activity spaces refer to the local areas within which individuals habitually move about in the course of their daily activities (Sherman, Spencer, Preisser, Gesler, & Arcury, 2005). Previously described as an experience of place, activity spaces have been extensively theorized and studied across multiple disciplines and traditions, with a particular focus on the utility for understanding healthcare accessibility across a diversity of populations (Fryer et al., 1999; Graves, 2008; Guagliardo, 2004; Nemet & Bailey, 2000; Newsome, Walcott, & Smith, 1998; Parker & Campbell, 1998; Townley, Kloos, & Wright, 2009). Though place is an expanding area of interest in the intersecting fields of substance use, harm reduction and HIV/AIDS research, approaches to studying its influence on health outcomes often rely on static measures of individual residence (Kwan, 2013). The spatial accessibility of health services, such as syringe exchange programs, is one promising area in which activity space research could impact health outcomes of mobile populations at high risk for injection-related morbidity and mortality.

Research in the field of primary medical care and cancer screening has shown that if a health care service is located within an individual activity space, utilization will increase (Dulin et al., 2010; Elkin et al., 2010; Engelman et al., 2002; Fryer et al., 1999; Kwan, 2013; Lian, Struthers, & Schootman, 2012; Mei-Po Kwan & Weber, 2003; Smith et al., 2013). Activity space methods have not been used to examine accessibility of prevention programs among street-based injection drug users (IDUs), a mobile population at high risk for HIV infection and overdose (Brouwer, Rusch, et al., 2012; Cooper, Bossak, Tempalski, Des Jarlais, & Friedman, 2009; DiMaggio, Bucciarelli, Tardiff, Vlahov, & Galea, 2008; Green et al., 2009; Stopka et al., 2012). Geospatial analyses of HIV and overdose have the potential to inform drug-related policy and prevention programs, such as where to place new syringe exchange programs, HIV testing sites, or drug treatment programs (DiMaggio et al., 2008; El-Bassel et al., 2011; Goldenberg, Stratthdee, Perez-Rosales, & Sued, 2012; Richardson et al., 2013; Taylor et al., 2011). A previous study of all heroin-related overdoses in San Francisco from 1997 to

∗ Corresponding author at: Department of Sociology, San Francisco State University, 1600 Holloway Avenue, San Francisco, CA 94132, United States.
Tel.: +1 415 338 2269.
E-mail address: alexismn@sfsu.edu (A.N. Martinez).

0955-3959/$ – see front matter © 2013 Published by Elsevier B.V.
http://dx.doi.org/10.1016/j.drugpo.2013.11.008
developed

2000 showed geographic clustering in one small central area of the city (Davidson et al., 2003). These findings contributed to the development of government funded overdose response training targeted at heroin users. Among IDUs, migration and mobility have been linked to high risk injecting behaviors in Vancouver (Rachlis, Wood, Li, Hogg, & Kerr, 2008), San Francisco (Hahn, Page-Shafer, Ford, Paciorek, & Lum, 2008; Montgomery et al., 2012), and New York City (Deren et al., 2003). Researchers in Vancouver found that sex workers who moved their working areas away from main streets as the result of local policing efforts were more likely to be pressured into unprotected sexual intercourse (Shannon et al., 2008). In Tijuana, mobile IDUs, or those who injected drugs more than 3 kilometers from their residence, lived in neighborhoods with less drug activity and were more likely to share needles and get arrested for carrying syringes (Brouwer, Lozada, et al., 2012; Brouwer, Rusch, et al., 2012).

We use activity spaces as an analytical framework to study intra-urban mobility among street-based IDUs in San Francisco and expand the conceptual focus of place from static residential spaces to habitually visited locations in people's everyday lives. Geographic information systems (GIS) software allows us to map individual level geographic data that includes habitually visited locations where study participants sleep, use drugs, and hang out during the day. Although there are multiple approaches to measuring activity spaces, which include the use of two dimensional ellipses, kernel densities and shortest paths networks, the calculation of distance traveled between locations of regularly visited geographic locations, such as where one sleeps, works, and socializes with family and friends, is central among all of them (Morency, Paez, Roorda, Mercado, & Farber, 2011; Paez, Mercado, Farber, Morency, & Roorda, 2010; Wong & Shaw, 2011).

To examine accessibility of syringe exchange programs (SEPs) using an activity space framework, we use street-based networks to identify the shortest path routes between participating locations. We further examine the associations between distances of activity space routes and health-related outcomes, including HIV serostatus, syringe sharing, and overdose.

Methods

Data collection procedures

The Urban Health Study (UHS) was a study of street-recruited IDUs in the San Francisco Bay Area (Kral et al., 2001). In this analysis, we used self-report data from a cross-section of IDUs interviewed in San Francisco between 2004 and 2005 (N = 1084). Recruiting and sampling procedures were based on targeted sampling procedures developed at UHS (Bluthenthal & Watters, 1995) and utilized in many National Institute on Drug Abuse (NIDA) funded studies of IDUs, including the 25-city NIDA Cooperative Agreement in the 1990s (Kral, Bluthenthal, Booth, & Watters, 1998). To summarize briefly, targeted sampling consists of mapping of county and city indicators to identify those areas with an increased prevalence of drug use, which is followed by ethnographic mapping of promising Census tracts, neighborhoods, or other geopolitical centers. Reliable and up-to-date information about IDUs in a community are obtained through ongoing observations and social contact with individuals knowledgeable about IDU social networks, “coping spots”, shooting galleries, and other locales frequented by IDUs. Recruitment is conducted by outreach workers who are familiar with the communities.

Eligibility criteria for the study include being aged 18 years or older and drug injection within the past 30 days, as verified by self-report and physical examination for visible signs of recent venipuncture or dermapuncture consistent with drug injection (e.g. “track marks”). The questionnaires were administered by trained and experienced interviewers, who used computer-assisted data collection on laptop computers in the field with Questionnaire Development System (QDS) software (NOVA Research Company, Inc., Bethesda, MD).

Individual-level measures

Dependent variables. We examine three health-related outcomes: (1) HIV serostatus, (2) syringe sharing, and (3) non-fatal overdose in the past 12 months. Syringe sharing is a standard behavioral measure of HIV risk among IDUs and has been used extensively in socio-epidemiological studies (Kral et al., 2003; Kral, Bluthenthal, Erringer, Lorvick, & Edlin, 1999) Participants were asked to report the number of times they engaged in either distributive or receptive sharing in the past six months. These variables were recoded to a ‘1’ if at least one occurrence of either distributive or receptive syringe sharing occurred in the time period and a ‘0’ if IDUs reported zero occurrences of sharing syringes. Fatal and nonfatal overdose has been previously studied as a major cause of morbidity and mortality among injection drug users (Seal et al., 2001). We defined recent nonfatal overdose as a self-reported overdose that occurred in the past 12 months prior to being interviewed.

Independent variables. Individual-level covariates included categorical measures of gender (male and female), age (under 30 vs. older age), race/ethnicity (white, African American, Latino, other), sources of income (government assistance or illegal means) in the past 30 days, years of injection drug use, and homeless status. Homeless status was ascertained by asking if a participant reported being homeless at the time of interview. Six month dichotomous measures of arrest history, injection and non-injection drug use (heroin, methamphetamine, and crack smoking), trading sex for cash or drugs, and frequency of syringe exchange program use were also ascertained. Residential transience was measured by asking “In the last 6 months, how many other locations have you slept?” For statistical analysis, we added one to the number of additional locations reported in a 6 month time period and divided this total by 180, or the number of nights in a 6 month period.

Activity space variables

To document locations where participants sleep, hang out, and use drugs, the study questionnaire included the following three questions: (1) “In the last 6 months, what is the intersection nearest to where you most often hang out during the day?” (2) “In the last 6 months, what is the intersection nearest to where you most often sleep at night?” and (3) “In the last 6 months, what is the intersection nearest to where you most often use drugs?” All reported street intersections were geocoded as points using the San Francisco street network. All geospatial analyses were performed using ArcGIS software (ESRI, Redlands). Locations where participants usually sleep were also geocoded to the level of the Census tract. We had 90% accuracy in successfully mapping and geocoding reported intersections.

Activity space routes

To calculate routes between each of the three locations reported by a participant, we used the New Route tool in the Network Analyst extension. Fig. 1 depicts the methodological steps involved in creating the routes. Circles labeled ‘1’ represent geocoded locations where participants usually sleep at night. Circles labeled ‘2’ represent geocoded locations where participants usually hang out during the day. Circles labeled ‘3’ represent geocoded locations where participants usually use drugs. ArcGIS drew a route to connect each of the three locations. The route begins at the location where participants usually sleep and ends at the location where participants
Fig. 1. Participant locations of sleeping, hanging out and using drugs (N=2861).

usually use drugs. Routes were not drawn for participants with more than one missing location. Calculation of activity space routes is made possible through the use of a San Francisco street network shapefile accessed from the public GIS portal through the City and County of San Francisco. After activity space routes were successfully created in ArcGIS, we created two new variables: activity space distances and syringe exchange program accessibility.

Activity space distances
To calculate the distance between the locations where participants sleep, where participants hang out, and where participants use drugs, we used the OD (origin-destination) Cost Matrix tool in the Network Analyst extension. The OD cost matrix finds and measures distance between points along a street network, rather than a straight-line, from multiple origins to multiple destinations. When configuring an OD cost matrix analysis, it is possible to specify the number of destinations to find. We specified the point of origin as where participants sleep. The OD cost matrix calculated the shortest route distance, measured in units of miles, between where participants sleep, where they hang out, and where they use drugs. Distance of the entire activity space route The OD cost matrix analysis calculated the total distance of the activity space routes.

Syringe program accessibility
We used the ‘points to lines’ join feature in ArcGIS to identify if individual activity space routes intersect with location of SEPs.
buffer of 50 meters is used around each activity space route. Data for locations of all SEPs during the same time period (2004–2005) were identified previously for another analysis (Wenger et al., 2011). Seventeen unique SEP locations were mapped during the two-year time period. ArcGIS created a dichotomous variable with a ‘1’ denoting if a participants’ route intersects with any SEP location.

**Census tract-level measures**

Poverty level is the only Census tract variable included in the statistical analysis of all three outcomes. Poverty level in the United States is defined as a set of money income thresholds that vary by family size and composition to determine who is poor. In 2000, a family of four, with two related children under the age of 18, will count as poor if the total family income is less than $17,463 (cite: http://www.census.gov/prod/2001pubs/p60-214.pdf). We dichotomized the poverty threshold into low and high categories. Census tracts with more than 20% of households reporting income below the federal poverty level are classified as high poverty and tracts with less than 20% of households reporting income below the poverty level are classified as low poverty. Concentrated poverty is defined in the literature as a range of 40–20% of Census tract households living in poverty (Alexassensoh, 1995; Lichter, Parisi, & Taquino, 2012). The mean and median percentage of households in poverty in San Francisco is 22% and 21%, with a maximum of 52%. Because only 0.8% of the tracts (n = 7) met the definition of concentrated poverty, we used 20% as a threshold that results in enough variation to compare the tracts in each category. The dichotomous measure of concentrated poverty was linked to the individual-level data using the Census tract where participants usually sleep.

**Statistical analysis**

Depending on the level of variable measurement, we calculated frequencies, means and standard deviations, medians and interquartile ranges, as appropriate. Logistic regression models were estimated to assess the magnitude of the association between activity space variables and the three outcomes of HIV seropositivity, syringe sharing, and overdose. First we fit logistic regression models to estimate the association between activity space variables (distance and SEP accessibility) and outcomes of HIV serostatus, syringe sharing, and overdose after adjusting for all covariates. Covariates selected for model building were based on p-values below .10. We fit each model using methods of backward elimination. The parameter estimates of each outcome in multivariate analysis are associated with a one-unit change in the activity space distance variable. Each estimated coefficient is the expected change in the log odds of an outcome for a unit increase in the corresponding continuous independent variable holding the other covariates constant. No efforts were made to categorize activity space distance into groups due to the exploratory nature of this measure and its skewed distribution.

Given the multiple levels of data included in the multivariate analysis, potential clustering of participants at the level of

| Table 1: Characteristics of unduplicated UHS study participants between 2004 and 2005 (N = 1084) by activity space variables. |
|--------------------------------------------------|----------------|----------------|
| Total sample N = 1084 | Activity space distance N = 989 | SEP Accessibility N = 96 |
| **Health-related outcomes** | **Mean, standard deviation** | **Percentage** |
| HIV seropositivity | 12% | 0.87 (2.4) | 5.5% |
| Syringe sharing in past 6 months | 35% | 1.8 (2.9) | 8.8% |
| Non-fatal overdose in the past 12 months | 9% | 2.3 (3.6) | 10.4% |
| **Individual-level variables** | | |
| Male | 75% | 1.6 (2.5) | 10.1% |
| Female | 25% | 1.5 (2.7) | 7.7% |
| **Age** | | |
| Under 30 | 5% | 1.9 (3.0) | 15.4% |
| 30–49 | 62% | 1.6 (2.7) | 9.4% |
| 50 and over | 33% | 1.3 (2.3) | 9.3% |
| Considers self homeless | 59% | 1.6 (2.6) | 7.9% |
| **Race/ethnicity** | | |
| Black | 40% | 1.2 (1.9) | 13.1% |
| White | 42% | 1.5 (2.6) | 8.4% |
| Latino | 8% | 2.8 (3.4) | 6.0% |
| Other | 10% | 1.4 (2.0) | 4.7% |
| **Received government assistance in past 30 days** | 33% | 1.4 (2.2) | 7.7% |
| **Illegal source of income in past 30 days** | 36% | 1.7 (2.7) | 7.7% |
| **Traded sex for drugs or cash in past 6 mo** | 16% | 1.4 (2.0) | 9.6% |
| **SEP use in past 6 months** | | |
| No use in past 6 months | 12% | 1.9 (2.5) | 11.7% |
| Less than once a week | 41% | 1.5 (2.5) | 10.2% |
| Once a week or more | 47% | 1.5 (2.7) | 9.3% |
| **Residential transience** | | |
| Number of locations slept in past 6 mo | 3.6 (4.1) | 2.0 (3.0) | 2.4 (2.7) |
| Slept in >3 locations past 6 months | 31% | | 7.9% |
| **Drug-related variables** | | |
| Smoking crack cocaine in past 6 mo | 71% | 1.6 (2.6) | 8.8% |
| Heroin injection in past 6 months | 71% | 1.7 (2.7) | 9.2% |
| Methamphetamine injection in past 6 months | 32% | 1.2 (2.1) | 8.7% |
| Injection drugs <10 years | 15% | 1.6 (2.4) | 9.6% |
| Census tract-level variables | | |
| Concentrated poverty | 61% | 1.1 (2.1) | 9.5% |
Census tract of residence was assessed using intraclass correlations (Hedeker, Gibbons, & Flay, 1994; Larsen & Merlo, 2005; Wright, Bobashev, & Novak, 2005). Our sampling methods did not include nesting of participants within Census tracts so it was unclear whether autocorrelation of respondents would violate the assumption of independence for ordinary least squares regression analyses and increase type I error rates. Intraclass correlations computed in SPSS showed that variability at the census tract level was not independent of variability at the individual level. Therefore we did not utilize multilevel logistic models with random intercepts to measure between group variations in the outcome as a percentage of total variation in the outcome (which is comprised of within- and between-group variance). Rather, all multivariate analyses were conducted using ordinary least squares regression in SPSS Version 20.0, IBM, New York).

**Thematic mapping**

ArcGIS software was used to create all thematic maps (ESRI, Redlands, CA). All street-based network and census tract shapefiles were accessed from the publicly available GIS enterprise data clearinghouse operated by the City and County of San Francisco. The purpose of thematic mapping is to visualize the distribution of activity space routes across the city of San Francisco.

Fig. 2. Routes that link locations of sleeping, hanging out and using drugs (N=989).
Missing data

There were no statistically significant differences between participants with any missing data and everyone else by variables of gender, race, age, and homelessness. We examined the characteristics between the two groups to ensure that homeless IDUs were not more likely to be classified as missing. Therefore we assume the missing data to be randomly distributed rather than due to a bias that prevents further analysis of the type of activity space routes and distances.

Results

Descriptive statistics of sample

The participants in our sample were ethnically diverse, predominately homeless males with a long history of injection drug use (Table 1). 61% of participants reported usually sleeping in Census tracts with 20% or more households living in poverty. Twelve percent of the sample tested positive for HIV infection at the time of interview, 35% reported syringe sharing in the past 6 months, and
9% reported at least one non-fatal overdose in the past 12 months. All activity space locations reported by participants were within the City and County of San Francisco.

Mean activity space distance for all participants was 1.5 miles with a standard deviation of 2.6 miles. The median distance was 0.24 miles with an interquartile range of 2.1 miles. Two percent of the sample had an activity space distance of 10 miles or more, whereas 36% of the sample had an activity space distance of 0 miles, meaning they reported the same geographic intersection for all three questions (sleeping, hanging out, using drugs). The maximum distance reported by any one participant was 16.6 miles, which can be explained by movement between San Francisco and Treasure Island, an island that is part of the City and County of San Francisco and is accessible via bus and car. Residential transience was high, with a mean and standard deviation of 2.7 (4.4) different sleeping locations reported by participants over a 6 month period. Participants who slept in more than 3 different locations over a 6 month period also had higher mean activity spaces. Participants who most often slept in concentrated poverty tracts had lower mean activity space distances than participants in low poverty tracts (Table 1).

Activity space routes, with a buffer of 50 feet, intersected with at least one SEP for 96 participants (9.7%). The mean activity space distance for these 96 participants is 2.3 miles, which is significantly higher than the mean distance for participants with routes that did not intersect an SEP (1.4 miles, p = 0.002). Frequency of SEP use was not higher among IDUs with activity space routes that intersected an SEP. Participants that used an SEP at least once a week in a 6 month period of time also had the smallest activity space distance compared to participants with less frequent usage.

### Statistical analysis

Table 2 shows that activity space distance had an inverse relationship with HIV positivity, with a unit increase in distance decreasing the odds of being HIV positive by 19%. The odds of syringe sharing increased by 11% for every one-unit increase in residential transience, or the number of different locations where participants slept in the previous 6 months. Residing in a tract with concentrated poverty decreased the odds of syringe sharing by 20%. SEP accessibility in an activity space was not associated with any of the three health-related outcomes.

### Conclusion

Our study focuses on activity spaces among street-based IDUs living in San Francisco, a densely populated urban city with one of the highest median individual incomes in the United States (Census 2012). Among IDUs, activity space distance is only associated with HIV seropositivity. We found that residential transience and sleeping in a concentrated poverty Census tracts is associated with the outcome of syringe sharing but in different directions, with transience increasing the odds of syringe sharing and sleeping in poor tract decreasing the odds of syringe sharing. SEP accessibility was not identified as significant for any of the three health related outcomes. Place-based measures, including activity space distance, SEP accessibility, residential transience, or concentrated poverty Census tract, do not help explain the outcome of non-fatal overdose in the past 12 months among IDUs.

Our finding that activity space distance is not associated with syringe sharing differs from what has been previously reported in the literature (Hahn et al., 2008), and brings up interesting questions about the unique social geography and policy climate of San Francisco as well as methodological differences in studying place. Syringe sharing has been shown to be higher among geographically mobile IDUs in Tijuana (Brouwer, Lozada, et al., 2012). For IDUs in San Francisco, activity spaces are likely shaped by topography, policies that criminalize drug use, and the distribution of social, medical, and prevention services (Galea & Vlahov, 2002; Iguchi...
et al., 2002; Shannon et al., 2008). It is possible that the unique topography of San Francisco, ranging from heights of sea level to nearly 1000 feet laid out over a grid of some 40 hills, reduced the size of activity spaces among IDUs (City of San Francisco, 2012). The availability of sterile syringes from multiple legally operated syringe exchange programs in the densely populated downtown commercial area of San Francisco may also reduce the pressure to be mobile (Bluthenthal, Kral, Ernirger, & Edlin, 1999; Martinez et al., 2007). Likewise, IDUs residing in Census tracts with lower levels of poverty might have less street-based access to syringe exchange programs and/or illicit drugs, thus necessitating travel to drug scenes in high poverty Census tract (Bourgois & Schonberg, 2009; Burris et al., 2004).

Our data suggests that SEP utilization does not increase with accessibility of an SEP along an activity space route. Mean activity space distance among participants with routes that intersect the location of an SEP is higher than the mean activity space distance of all participants. Fig. 4 shows that five of these activity space routes extend to more geographically isolated areas of San Francisco. These geographically isolated areas are characterized by single family homes and lack of a commercial business zone (City of San Francisco Mayor's Office, 2012).

Although long activity space routes may increase syringe exchange program accessibility, it does not necessary translate into increased patterns of usage, as suggested by our findings. Rather, habitual movements in a small geographic space that contains a syringe exchange program may be optimal for increasing utilization. Participants may perceive minimal risk of arrest or other negative experiences in familiar neighborhoods. HIV positive IDUs have smaller activity spaces. Though it is likely that IDUs in our study who tested positive for HIV at the time of interview already knew of their HIV status and thus were stably housed as a result of their diagnosis (Aidala, Cross, Stall, Harre, & Sumartojo, 2005), this finding also highlights the advantages of a small geographic space for a vulnerable population.

Research shows that being in an unfamiliar place increase risk of overdose (Brugal et al., 2002; Green et al., 2009; Sherman et al., 2002). It is possible that our use of an activity space framework does not capture the new and unfamiliar spaces where study participants experienced an overdose. Future research should also query participants about geographic locations of event based outcomes like syringe sharing and overdose (Davidson, Scholar, & Howe, 2011). Finally, a temporal discrepancy in measurement of activity spaces over a 6 month period of time and overdose prevalence over a 12 month period of time could bias our findings.

We are limited in our interpretation of activity space variables. These limitations include assessing the temporal nature of this movement, given that we do not if or when, a participant in our study moved between the reported three geographic locations. The context of when and how often (e.g. daily, weekly, monthly) someone moves between these locations to hang out, sleep, and use drugs is a dimension of activity spaces that needs further investigation. Further, we sought to ascertain extremely sensitive information from our participants during a face to face interview. The Urban Health Study is well known and recognized in the drug user community after conducting 16 years of community-based HIV testing. This longevity created a trusted environment in which participants were assured that information about the geographic location of their illegal drug use would remain confidential. Finally, we are limited in our capacity to generalize our claims presented in this paper. Because injection drug use is an illegal behavior, it is impossible to use methods of random sampling to recruit our study sample, and as a result, we rely on a convenience sample of IDUs.

Our findings have interesting methodological implications for studying place from more than a one-dimensional variable based on location of residence. Aggregate Census-based variables are used by researchers to estimate “contextual” or “neighborhood” effects (Caughy, O'Campo, & Patterson, 2001). Critiques regarding the validity of these measures include the conceptual relevance of Census boundaries as proxies for neighborhoods as well as the length of exposure to neighborhood characteristics if the population of interest is highly mobile and unstably housed. It is possible to explore these questions in a mixed methods context, merging methodological tools such as GIS with place based narratives that bring texture and depth to the physical locations such as those reported by our participants in this study (Hawthorne & Kwan, 2012) Another limitation in this analysis is the use of routes rather than a standard deviational ellipse to represent a zone of activity spaces (Wong & Shaw, 2011). While we offer a new approach to studying accessibility of SEPs along individual activity space routes, we did not have enough visited locations to meet the geometric requirements for defining an ellipse computationally (Newsome et al., 1998). Future methodological approaches to studying activity spaces should include more detailed collection of types, frequency, and timing of habitually visited locations that can be used to create ellipses rather than routes (Sherman et al., 2005). Furthermore it is likely that participants did not travel the exact routes mapped by ArcGIS as the shortest paths between points. One strategy to address this limitation without the necessary amount of visited locations is to create a larger buffer than 50 feet around each activity space route. It may be possible to document all geographic locations that an individual has direct contact with as a result of his or her day to day activities through the use of travel diaries or smartphones. This type of detailed data collection would expand the methodological possibilities for refining measures of activity spaces in this population.

Our exploratory approach to represent activity spaces among injection drug users can be used as to generate new research questions about HIV and overdose prevention program accessibility. Nevertheless it is critical to balance privacy of place in a vulnerable population with the policy and programmatic gains from pushing the conceptual and methodological boundaries of studying place and drug user health.

Conflict of interest

None of the authors (Martinez, Kral, Lorvick) have any financial conflicts of interest to disclose.

References


