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A GIS-based methodology for improving needle exchange service delivery

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Abstract

Background—A variety of legal, social and logistical factors can prevent individuals from accessing formal needle exchange programs. One common solution to this problem is satellite exchange, which involves collaborating with people who already use an exchange to deliver needles and other supplies to those unable to access the exchange. While this approach can be very successful, one potential problem is that those most willing to deliver needles to their peers are often members of social networks that are already well connected with the needle exchange, leading to duplication of effort.

In this paper we describe a simple and novel method for identifying groups of people who are demonstrably in need of improved access to needles, and for re-targeting efforts to meet the needs of those people. The method described was piloted at the Homeless Youth Alliance, San Francisco, USA, and further refined at Clean Needles Now, Los Angeles, USA.

Methods—People accessing needle exchange sites were asked to participate in a survey with two questions: “where were you and what time was it last time someone borrowed a needle from you?” and “where were you and what time was it last time you had to borrow a needle from someone else?” Responses were geocoded, and maps produced showing ‘hotspots’ where people were frequently finding themselves without needles.

Results—Satellite needle exchange was refined from an ad-hoc activity into one which focused on delivering needles to those with empirically demonstrable need. Maps produced in the process also proved valuable in discussions with local officials and other agencies about funding, as well as needle provision policy and practices.

Conclusion—We describe a method for rapidly assessing, describing, and responding to unmet and under-met need among injecting drug users. The method is particularly well-suited to organizations with extremely limited resources.

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Conflict of interest statement

The authors declare that they have no financial or personal relationship with people or organisations that could inappropriately influence this work.

Keywords

GIS; needle exchange; satellite exchange; secondary exchange

Background

Needle exchange is a well-proven public health response to HIV and other blood borne illnesses among injecting drug users (Wodak & Cooney, 2005). However, a variety of legal, social and logistical factors can prevent individuals from accessing formal, fixed site needle exchange programs. These include fear of police, fear of being identified by other community members as an injecting drug user, limited operating hours, and difficulty accessing the physical locations of exchanges (Heimer et al., 1996; Bluthenthal et al., 1997; Gostin, 1998; Rich et al., 1999; Cooper et al., 2005; Bruneau et al., 2008). These in turn are often caused or exacerbated by broader structural barriers to establishing and operating needle exchanges, such as stigma against drug users (Room, 2005; Radcliffe & Stevens, 2008; Simmonds & Coomber, 2009), NIMBYism (Takahashi, 1997; Shaw, 2006; Tempalski et al., 2007), and similar localized social and political conditions (Tempalski, 2007). One common solution to this problem is satellite, or secondary exchange, which involves collaborating with people who already use an exchange to deliver needles and other supplies to those unable to access the exchange (Valente et al., 1998; Tyndall et al., 2002; Snead et al., 2003; Murphy et al., 2004; Voytek et al., 2003). In some locations, a dispersed drug user population and/or a particularly hostile policing environment has made satellite exchange the only viable form of needle provision (Anderson et al., 2003; Irwin et al., 2006).

Based on the understanding that not all injectors could or would access traditional fixed-site needle exchanges, in 2006 the California State Department of Health Services, Office of AIDS provided funding for formal satellite exchange programs to be delivered by existing needle exchanges via a competitive grant mechanism. The aim of these programs was “to extend the viral prevention services of existing SEPs to a broader community of IDUs, and .. to decrease potentially risky behaviors among SSEs while they reach out to IDUs during prevention efforts.” (California State Department of Health Services, Office of AIDS IDU-SSE High Risk Initiative, 2010).

Two organizations who successfully applied for this funding were the Homeless Youth Alliance (HYA) in San Francisco and Clean Needles Now (CNN) in Los Angeles. Both organizations emerged from community-based HIV-focused activism in the late 1980s, and both have historically enjoyed a level of support from local (city/county) government unusual in the United States. However, both have also struggled with many of the structural barriers to effective service described above, including policing practices, NIMBY-ism, organizational co-optation, and significant resource limitations (Moore & Wenger, 1995; Bluthenthal et al., 1997; Weiker et al., 1999; Sears et al., 2001; Knight, 2007). Finally, both organizations also had considerable prior experience conducting both formal and informal satellite exchange.

Extending from these experiences, in the HYA grant application to the California Office of AIDS, we (Davidson and Howe) pointed out that historically many exchanges conducting formal satellite exchange simply recruited those exchange users who displayed the most enthusiasm for the project. We hypothesized that a potential problem with this practice was that the satellite exchangers recruited in this way may well be members of social networks already well connected to the exchange, and their enthusiasm might be due in part to the social standing associated with working with a valued community organization. As such, recruiting these individuals, while still a positive experience for all concerned, might lead to

a considerable amount of effort being devoted to providing another way for already well-served groups to obtain needles, rather than reaching those who are genuinely unwilling and/or unable to access the exchange themselves.

To address this problem, we proposed a GIS-based method for identifying groups of people who are demonstrably under-served by existing exchange services, and for re-targeting satellite exchange efforts to meet the needs of those people.

GIS-based approaches have a long history in public health research, dating at least to John Snow's (1855) work on cholera outbreaks in London in the 1850s. More recently, GIS-based methodologies have been employed to achieve a variety of goals in the drug field, including analysis of the spatial distribution of drug use (Latkin et al., 1998) and the spatial distribution of HIV-related services (Buxton et al., 2008); studying the environmental contexts of drug use (Oliver-Velez et al., 2002) and drug use networks (Wylie et al., 2007); as well as for more applied uses, such as evaluating the impact of drop-boxes on street-discarded needles (de Montigny et al., 2010) and the impact of physical distance from needle exchanges on HIV risk behaviors (Bruneau et al., 2008). Geographic approaches have also been used to explore how neighbourhood-level sociostructural factors impact drug user health (Cooper et al., 2009; Gnreux et al., 2010), and to theorize the impact of drug user spatial mobility on individual risk behaviour (Kwan et al., 2008).

In this paper, we describe the method used in San Francisco and Los Angeles in detail, along with preliminary outcomes from its use in both locations. We discuss future extensions of and uses for the methodology.

Locating need: a method for mapping places where people frequently run out of needles

As originally piloted at the Homeless Youth Alliance in San Francisco, and later refined at Clean Needles Now in Los Angeles, the method consists of three steps: 1) surveying exchange users to find out where (and when) they and their peers found themselves without needles when they needed one; 2) mapping those locations to identify 'hotspots' where people often run out of needles; and, most importantly, 3) pooling the knowledge of exchange users and exchange staff to interpret the maps and to design locally-appropriate methods to deliver needles to the people and locations identified in the mapping exercise.

The method, while incorporating some quantitative techniques (brief quantitative surveys and mapping), might nonetheless be better understood as a qualitative methodology. As exchange staff and exchange users think about the social situations in which injecting is occurring, as well as how best to ensure sufficient needles are present in those situations for people to have the option of using new needles for every injection, quantitatively-derived maps are a useful adjunct to these conversations, rather than an inherent end in themselves.

Step 1: Gathering data—Users of each needle exchange were surveyed over several months to find location and time information associated with the last time they had given someone else a needle, and/or the last time they had themselves had to ask someone else for a needle. More specifically, we asked: "What was the nearest intersection / cross street the last time someone borrowed a needle from you?" and "What time of day or night was it?"; or alternately "What was the nearest intersection / cross street the last time you had to borrow a needle from someone else" and "What time of day or night was it?"

At the HYA needle exchange in San Francisco, where little or no direct data collection takes place, we created simple paper forms with two questions on them, and put up a sign in the exchange space asking exchange users to fill in a form to help us improve our services. Some exchange staff also periodically drew attention to the survey, letting people know that

the survey was being carried out if they were interested in participating. At the request of exchange staff, who had asked that the survey be limited to two questions, half the forms asked the first set of questions given above; half asked the second. By keeping the survey separate from other activities in the exchange, we sought to minimize the impact of survey data collection on normal exchange operations, and also to attempt to avoid any implication that participating in the survey was a requirement to use exchange services. While low-impact, this approach also reduced response rates.

At CNN in Los Angeles, the exchange was already required by local authorities to ask every exchange user a short list of demographic and drug use questions when exchanging needles. All questions described above were added to this survey tool. An additional advantage of incorporating the questions into a broader survey is that other variables are available for incorporation into maps—possible hypothetical examples include maps showing only locations where people ran out of needles outside needle exchange operating hours, or showing only locations where female respondents reported giving someone else a needle.

In both cases, sample size was informed by the grounded theory concept of ‘saturation’ rather than by methodologies derived from statistics. In most grounded theory research, sampling (or qualitative interviewing) continues until new interviews cease to add new information to what is already known about a situation under analysis (Strauss 1987, pp.16–21; Strauss & Corbin 1998, p.136). For example, the first five interviews with people about a given situation are likely to be rich with new concepts and new information about that situation, but in most cases by the fiftieth interview only tiny nuances will be being added to what is already known from the previous forty nine interviews, and the researcher will declare that saturation has been achieved. Likewise, when mapping locations where people run out of needles, in most instances even a handful of data points will start to show some clustering effect. As more data points are added, additional clusters may also be revealed, however the original clusters do not (and cannot) disappear—they may either become more dense or stay at the same density, but they cannot become less dense. Either way, as more and more data points are added to the map, the map will begin to ‘stabilize’: existing clusters will slowly become more dense, but new clusters cease to appear and the map can be said to have reached ‘saturation.’ More nuanced research questions can increase the size of the sample needed to reach saturation—for example, a hypothetical map of locations where female respondents report running out of needles during hours when the exchange is normally closed would be expected to require more overall survey responses than a simple map of locations where any respondent reported having to ask for a needle at any time of day or night.

In the San Francisco case, a combination of an organizational culture which preferred to keep formal data collection activities to an absolute minimum, and a limited aim of identifying one or more groups of people with a demonstrable need for more needles led to a tiny sample size—approximately 25 surveys, 18 of which had usable location data. While these data could in no way be argued to provide a comprehensive and accurate map of unmet need in San Francisco, they did serve to identify two locations close to the exchange where people were reporting running out of needles. The presence of specific drug using communities in those locations was confirmed by consulting exchange users and outreach staff.

In the Los Angeles case, a more ambitious desire to gain a clear understanding of systemic patterns of need required a larger sample before the map could be said to have reached ‘saturation.’ In this case, 224 people were surveyed during the pilot phase, and periodic re-sampling has continued since the completion of the pilot phase with the intent of allowing changes over time in the distribution pattern to be documented.

Step 2: Mapping collected data—A simple spreadsheet was created with the following fields: survey date, intersection, time of day, directionality (ie whether the respondent had given someone a needle or received one from someone else), and, (for Los Angeles only) gender of respondent. In San Francisco paper survey forms were manually data entered into the spreadsheet. In Los Angeles, data was either manually entered from paper or the relevant fields were exported into the spreadsheet from the data collection package used for regular data collection.

Intersection data was converted to latitude and longitude points (geocoded) using the publicly available Google Maps Application Programming Interface (Google, 2010). Responses that were not geocodable due to either lack of specificity (for example where the respondent had described a neighbourhood or region rather than an intersection) or error (for example where two streets which do not intersect were named) were discarded.

A geographic database was created using the free, open source geographic information system (GIS) software *Grass GIS* Version 6.2 (GRASS Development Team, 2006). The spreadsheet containing survey data was imported into the database, with survey date, time of day, directionality, and gender included as attributes of the point locations of the intersections. Publicly available GIS shapefiles of streets, local government boundaries, and other features of interest were obtained from the U.S. Census Bureau (U.S. Census Bureau, 2008), and imported into the database. Finally, the locations of every needle exchange provider in the County, with hours of operation as attributes, were also added to the database.

Maps were then generated showing where respondents reported borrowing needles from others or giving needles to others. Specific intersections in areas with high levels of drug use were often named by multiple respondents, so in order to avoid a response from one individual ‘hiding’ responses from many other individuals, ‘heat maps’, in which response density is indicated using a graduated colour scale, were used. Heat maps were generated using a moving 2D isotropic Gaussian kernel algorithm (Menegon & Blazek, 2006). Heat maps provide a visual representation of point density at a given location on a map relative to other locations on the same map; as such they are useful for quickly assessing clustering effects. An example of the output of this process is given in Figure 1, p.11, showing the Upper Haight neighbourhood of San Francisco, with several discrete hotspots within the adjacent Golden Gate Park.

We suggest that for exchanges without the resources to utilize GIS software, similar if more limited maps can be produced by using a paper map and marking reported locations with push-pins. As more pins are added, dense clusters of pins will indicate ‘hotspots’ as with the algorithmic technique described above.

Step 3: Utilizing maps—The final and most important component of this methodology is sharing and discussing maps with users of the exchange (and with exchange staff where exchange staff are engaged in outreach activities). At the Homeless Youth Alliance in San Francisco, this was done in a highly informal manner, by simply bringing maps to the exchange during opening hours and asking anyone present if they wanted to see the results from the brief surveys we’d been conducting in previous weeks. At Clean Needles Now in Los Angeles, we invited exchange participants and staff to share pizza outside exchange operating hours and talk about the maps we had produced. In both cases, the maps proved to be of high interest to both staff and participants, and generated considerable conversation about what the maps ‘meant’ as descriptors of the activities of people who used exchange services.

Use in San Francisco and Los Angeles

In San Francisco, as described above, the main aim of these meetings was to work out 'what's going on' at the hotspots the maps revealed—for example, working out that a hotspot at the edge of one park was connected to a particular cluster of amphetamine users, and then brainstorming about who from that community already used the exchange and might be willing to participate in satellite exchange. These conversations led somewhat organically to exchange users volunteering to conduct secondary exchange to those locations.

In Los Angeles, the identification of a large hotspot in Skid Row close to multiple needle exchange services (see Figure 2, p.13), led to a decision to re-focus outreach efforts in that area, and also provided a vivid illustration of the consequences of a range of local policies, ranging from City policy which favoured one-for-one exchange, to shelter policies banning injecting equipment, to policing policies oriented around the needs of developers in the area. The Los Angeles maps are currently being used as illustrations in discussions with City officials and other agencies operating in the Skid Row area around improving the efficacy of existing needle exchange service.

An additional significant and unanticipated benefit of the maps is as visual adjuncts to grant applications. In these, the maps serve two purposes: firstly, and most simply, they serve to graphically illustrate the need for the services for which funding is being sought. Secondly, they act to demonstrate to funders and potential funders that both the commitment and ability exist at an agency level to constantly re-evaluate and respond to changes in need in the community being served.

Finally, the maps show some promise as a way of tracking consequences of disruptive events such as police 'crackdowns' in specific areas or the relocation of social and medical services. By following subtle and gross shifts in where people report being at most need for clean needles, this methodology may have utility from both a pragmatic service delivery perspective as well as a public policy perspective.

Discussion and Conclusion

Surprisingly little work has been done on evaluating the effectiveness of satellite exchange at actually reaching individuals who cannot or will not visit an exchange themselves. An obvious problem in conducting such evaluation is that by definition the actual transfer of needles happens outside the gaze of the needle exchange and researchers who might be associated with it. However, community-wide cross-sectional studies of injecting drug users which include questions about where needles were obtained have the potential to characterize satellite exchange users within the community, although to our knowledge relatively little has been published explicitly on this topic. The study by Sears et al. (2001), looking at a satellite exchange program conducted in San Francisco by one of HYA's organizational ancestors, is the only study we are aware of which explicitly attempted to measure the impact of a satellite exchange program on HIV risk behaviours in a large sample of injecting drug users.

In this paper we have described a method originally developed to improve formal satellite exchange programs run by fixed-site needle exchanges. The method as described has a number of obvious weaknesses for that purpose. Firstly, as implemented at HYA and CNN, the method describes the experiences of people who already use the needle exchange. In particular, by asking the question 'where were you last time *you* ran out of needles,' we gather data that shows where people who *are* willing and able to use the exchange are running out of needles—we map an under-served population rather than an unserved

population. We attempted to address this weakness in part by also asking our respondents where they were when they gave *someone else* a needle, and by creating maps which only included these responses. However, without knowing whether the person who was given a needle was someone who was or was not willing and able to use the exchange themselves, it will always be unclear exactly how much our maps show unserved groups as opposed to under-served groups. One possible solution to this particular problem would be to add our survey questions to the instrument of a larger study of injecting drug users being conducted by an external institution, but few needle exchanges have such a resource conveniently available to them.

A second limitation for some uses of the method relates to the way in which location data generated is strongly associated with the location at which it is collected. Maps generated using this method will inherently be maps of under-served and unserved groups with some level of geographic proximity to the location of the exchange/s at which the survey is conducted. In the case of HYA in San Francisco, this was considered desirable—we had only one exchange site, and we explicitly wanted to describe unmet and under-met need within the catchment area of that exchange. In the case of CNN in Los Angeles, where we had multiple exchange sites scattered across a large geographic area and where we wanted to characterize unmet and under-met need more generally within the community, one concern was that by sampling only at existing sites we would end up with maps which overemphasized under-met need in proximity to exchanges. Again, the best solution to this problem would be to also survey injectors outside exchanges, but again, the resources available to conduct comprehensive community-level surveying are well beyond that available to most needle exchanges.

Despite these limitations, our experiences suggest that the method is extremely useful for rapidly assessing, describing, and responding to unmet and under-met need among injecting drug users who use or associate with users of fixed site needle exchanges. The method is particularly well-suited to organizations with extremely limited resources, and can be conducted without the use of computer technology or related expertise.

Finally, as mentioned above, surprisingly little work has been done to evaluate the components of a successful satellite exchange, or even whether satellite exchange ‘works’. Further research in this area would be extremely helpful for improving the efficacy of a complex and valuable distribution modality.

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Figure 1. Upper Haight, San Francisco

Dotted areas are public parks; the black square shows the location of the HYA exchange site; shaded dark areas are hotspots.

Figure 2. Downtown Los Angeles

Black squares indicate location of CNN exchange sites; dashed area is the approximate border of 'Skid Row'; shaded dark areas are hotspots.