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Triangulating Syndemic Services and Drug Treatment Policy: Improving Drug Treatment Portal Locations in Baltimore City

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Abstract

The Problem: The prevalence of injection drug use (IDU) and incidence of human immunodeficiency virus (HIV) remain high in Baltimore, where IDU is a primary HIV risk factor. Substance use disorders and HIV are related syndemically—their causes and consequences interact synergistically. Baltimore is increasingly considering the syndemic relationship of substance use disorders, IDU, and HIV in making decisions about drug treatment funding and location.

Purpose of Article: Our goal was to empirically identify the optimal location of new drug treatment programs through the development and application of a novel, practical tool.

Key Points: Syndemic triangles were constructed to measure and visualize unmet need for drug treatment services. These data were used to determine priority zones for new treatment centers.

Conclusions: The application of this tool helped inform strategies for locating drug treatment services in Baltimore, and its successful use suggests its potential value in other metropolitan areas.

Keywords

Injection drug use; HIV/AIDS; drug treatment; health policy; geographic information systems; substance-related disorders; needle-exchange programs; health services accessibility; health services administration

IDU is a major risk factor for transmission of HIV in the United States, and, thus, a key driver of the nation's continuing acquired immunodeficiency syndrome (AIDS) epidemic.¹ The prevalence of IDU and the incidence and prevalence of HIV remain especially high in Baltimore.^{2–4} The Baltimore-Towson Metropolitan Statistical Area, which includes Baltimore City, as well as portions of Anne Arundel, Baltimore, Carroll, Harford, Howard,

and Queen Anne's counties, had the second highest prevalence of IDU (162 users per 10,000 residents) among large U.S. metropolitan areas in 2004.⁵ In 2002, the Baltimore-Towson Metropolitan Statistical Area tied with San Francisco for the 10th highest percentage of HIV-infected IDU (12%) among similar urban centers across the nation.⁶ In 2010, IDU was identified as the primary risk factor for 24% of the diagnosed HIV cases in Baltimore City.⁷

There is a clear etiologic link between the prevalence of substance use disorders and IDU and HIV incidence.⁸ Substance use disorders and HIV are related syndemically^{9,10}; that is, they constitute part of "a set of closely intertwined and mutual[ly] enhancing health problems that significantly affect the overall health status of a population within the context of a perpetuating configuration of noxious social conditions."^{9p.99} Substance use disorders, IDU, and HIV have been linked syndemically in various networks of diseases (e.g., the substance abuse, violence, and AIDS syndemic⁹; syringe-mediated syndemics¹¹; and the HIV, substance abuse, and mental illness syndemic).¹² In Baltimore, as in many urban settings, HIV transmission and IDU cluster among certain populations in certain spaces. This is not a simple matter of co-occurrence; rather, the co-location results from the fact that people and places share common socioenvironmental determinants, including historical and contemporary poverty and neighborhood disinvestment; discrimination by race, class, and sex/gender; and overarching structural violence.^{6,13} Furthermore, the consequences of HIV and substance use disorders (including those that manifest in IDU) exacerbate one another biosocially (as when the combined effects of IDU and HIV infection result in poor treatment adherence for both) and biomedically (related to reactions among injected drugs, HIV's immunodestructive processes, and AIDS-related sequelae).^{14–19} The interactions among these biological, social, and spatial "mutually reinforcing components of a syndemical health crisis"^{9p.109} have serious health implications at both the individual and population levels.²⁰

In response to the syndemic relationship between HIV and substance use disorders—and particularly the links between HIV and IDU—Baltimore increased financial support for various drug treatment modalities,²¹ most frequently through the nonprofit, quasi-governmental Baltimore Substance Abuse Systems, Inc. (bSAS; now subsumed under Behavioral Health System Baltimore). As of 2008, Baltimore City had the highest need for drug treatment of any urban center in the United States.²² From 1995 onward, bSAS served as the official substance abuse treatment and prevention authority for Baltimore City.²³ bSAS was funded by grants provided by the federal, state, and city governments, and the primary role of bSAS was to fund, advise, monitor, and evaluate treatment and prevention programs implemented by various stakeholders in Baltimore; however, bSAS was not a direct service provider. In addition to a range of substance use disorder treatment programs designed to help people achieve and maintain recovery—such as the Baltimore Buprenorphine Initiative and licensed, long-term residential programs²⁴—bSAS also funded needle exchange programs (NEPs) 6 days a week at 16 locations across the city.²⁵ Both treatment of substance use disorders and harm reduction programs have consistently proven effective in decreasing the incidence of HIV among users of injection drugs.^{26–29} Furthermore, researchers emphasize a mix of treatment modalities as key to stemming HIV transmission and IDU in urban settings.^{8,30–32}

Within Baltimore, there is significant residential clustering of injection drug users who are at high risk of acquiring or transmitting HIV.³³ bSAS recognized that place plays a critical role in the city's HIV and IDU challenges, and that the geographic overlap of people and places most directly implicated in HIV transmission, substance use disorders (particularly IDU), and treatment services are not simply coincidental, but rather part of a larger syndemic dynamic. Historically, bSAS measured unmet need for drug treatment services in the city at the zip code level, based largely on injection drug-using clients' self-reported residence. Over time, treatment portals have tended to cluster geographically, with the same treatment providers repeatedly funded to implement services in specific areas of certain zip codes. bSAS aimed to identify areas in which additional drug treatment services and NEP sites should be located so as to reflect the syndemic relationship between substance use disorders, IDU, and HIV—namely, at the nexus of places where people use injection drugs, where drug treatment portals do not already exist, and where HIV incidence is high.

To directly assist bSAS and to create a practical, evidence-based model for policymakers and service providers in similar urban centers, a partnership of Johns Hopkins Bloomberg School of Public Health researchers and bSAS administrators developed and implemented the “syndemic triangle” tool. Specifically, the director of bSAS approached researchers at Johns Hopkins who had conducted spatial analyses of other public health problems related to substance use. bSAS staff and Johns Hopkins researchers met to determine the project goals and objectives. bSAS contracted the researchers to develop a method to determine geographic unmet treatment need and produce several visual displays of the findings. Researchers and bSAS staff met monthly during the project. bSAS staff liaised with their board of directors, which included treatment providers, persons in long-term recovery, and community members.

The syndemic triangle tool uses geographic information systems to link city block-level data on IDU in defined Baltimore neighborhoods, HIV incidence at the zip code level, and location of drug treatment portals in Baltimore City. Although previous work in this area has examined clustering of HIV and IDU to establish transmission networks,^{34,35} study HIV subtypes,^{36,37} or basic epidemiologic data,³⁸ no studies have examined co-occurring IDU and HIV to establish geographic unmet treatment need. It provided a simple yet informationrich visual presentation of how the spatial distribution of IDU and HIV transmission in Baltimore overlapped with the City's existing drug treatment coverage area (which further reflected, albeit partially, the differential distribution of city resources among different neighborhoods). It also filled an important need for more spatially informed decision making on drug treatment services.^{6,39–41} This paper has two primary aims: 1) describe the empirical, policy, and programmatic implications and results of the application of the syndemic triangle tool in Baltimore and 2) analyze how those results helped to inform drug treatment policy and programming in Baltimore and, potentially, establish its usefulness in other metropolitan areas.

METHODS

Three sources of data, described below, were combined for this study. This study was reviewed by the Johns Hopkins Institutional Review Board and deemed non-human subjects research.

Environmental Data

The Neighborhood Inventory for Environmental Typology (NifETy) instrument includes 172 items operationalized within seven domains: 1) physical layout of the block, 2) types of structures, 3) adult activity, 4) youth activity, 5) physical disorder and order, 6) social disorder and order, and 7) violence, alcohol, and other drug (VAOD) indicators. The NifETy assessment used for this analysis was conducted independently by a pair of trained field assessors in summer 2007. Although environmental data were collected at the block level, they were operationalized at the neighborhood level. Block faces were randomly selected from each residential neighborhood in Baltimore City ($N = 242$), resulting in a total of 447 residential block faces.⁴² The raters travelled to their assigned blocks and performed the block-level assessments; raters spent an average of 30 minutes on each block. The environmental assessments were entered electronically, and the data were uploaded to a secure server for analyses.

The NifETy instrument has good psychometric properties,⁴³ with high reliability for the total scale (internal consistency reliability, 0.84), the VAOD subscale (ICC, 0.71), and across raters (ICC, 0.67–0.79). Validity metrics are also good; NifETy indicators of VAOD exposure correlated strongly with self-reported VAOD exposure from a sample of young adults and also with local crime data.⁴³ Two indicators of recent IDU were used for this investigation: 1) the presence of drug vials or vial caps and 2) the presence of discarded syringes.

Drug Treatment Data

The drug treatment portal data obtained from the Maryland Alcohol and Drug Abuse Administration, the state-level substance abuse authority, included geographic locations of all public and private licensed and operating drug treatment facilities and NEP van stops from 2007. Drug treatment centers are licensed through the Maryland Alcohol and Drug Abuse Administration, and each center must meet all federal and state regulations described in Maryland's annotated code. There were 79 public treatment facilities, 58 private facilities, and 26 NEP van stops for a total of 163 treatment portals.

HIV Data

The Maryland AIDS Administration provided HIV incidence rates from July 2006 to June 2007 at the zip code level ($N = 37$). The administration typically does not provide HIV data at smaller geographic units (e.g., neighborhoods) owing to privacy concerns. HIV incidence rates were used because incidence serves as an indicator of the contemporaneous risk of transmission in areas with IDU evidence.

Spatial Analysis

All spatial analyses were performed using ArcGIS 9 (ArcMap 9.2). The 447 randomly selected city block faces assessed using the NIfETy instrument were mapped, and the block faces with no evidence of IDU and zip codes that fell mostly outside of Baltimore City were excluded, creating a pool of 176 block faces across the 18 zip codes within the city. The geographic locations of drug treatment portals and the HIV incidence data were added to the map using two spatial overlays.

Figure 1 presents a visual representation of the calculations for each of the 176 syndemic triangles for the block faces with evidence of IDU. Using the geocoded data described, “syndemic triangles” were constructed to measure and visualize unmet need for drug treatment services. This unmet need was defined along two dimensions: 1) the proximity of the block face to a treatment portal and 2) the overall level of HIV incidence in the zip code to which the block face belonged. The base of each syndemic triangle was the scaled distance between a block with evidence of recent IDU (per the NIfETy criteria; see above) and its closest treatment portal. The base distances were scaled to reflect relative distance between a given block face and a treatment portal by taking the distance from a particular block face to the nearest treatment center and dividing that by the largest possible distance between a block face and a treatment center out of the 176 distances. The resultant base distances ranged from close to zero to 1. The height of each triangle was calculated as the scaled incidence of HIV in the zip code containing the block face with evidence of recent IDU. The scaling was relative to the zip code with the highest HIV incidence. The area of the triangle, a proxy for unmet drug treatment need, was then calculated using the formula $\frac{1}{2}(\text{base}) \times \text{height}$. Larger triangles reflect a combination of longer distances between IDU evidence and treatment portals and higher HIV incidence rates.

RESULTS

Empirical Results

The areas of the syndemic triangles ranged from 0.0 to 0.18 ($M = 0.04$; $\sigma = 0.03$). As explained, larger areas indicate greater unmet drug treatment need. Figure 2 depicts visual proxies of the 176 syndemic triangles constructed for the block faces with evidence of use. The equilateral triangles in Figure 2 are stock ArcMap symbols, and their sizes reflect the categories displayed in the Figure 2 legend, rather than reflecting the dimensions of the isosceles triangles described.

Table 1 summarizes the results for the 10% of block faces with the highest unmet treatment need according to triangle area. When triangle area was summed by zip code for these areas, the 21218 zip code had the highest total area and greatest unmet treatment need (0.55) and the adjacent 21213 zip code had the second highest total area (0.52). In addition, five block faces in the 21218 zip code appeared among the 18 block faces comprising the top decile by triangle area (Table 1). The areas around those five block faces were presented to bSAS as priority zones that should be targeted for new treatment centers.

Policy and Programmatic Results

After identifying priority zones based on the empirical results, bSAS released a call for proposals focused on providing treatment services in one of the zones with the greatest unmet treatment need. An existing treatment-providing organization was contracted to establish a treatment facility in that zone. As a preliminary step in this process, the organization advertised its intent to establish the new treatment center to residents of the selected area. Some residents, however, protested the establishment of a drug treatment center in their neighborhood. Subsequently, the Baltimore City Zoning Board denied the organization's request for the location of the substance abuse treatment center, citing language added to the Baltimore City Zoning Code in 1962. This language addressed guidelines for "homes for non-bedridden alcoholics,"^{44p.445} a category that, according to the city, included treatment centers. The zoning code prohibited the location of treatment centers in many parts of the city outright. In those zones in which the code did not completely prohibit residential treatment centers, it restricted their establishment as a conditional use. A conditional use permit allows jurisdictions to consider uses which may be essential or desirable, but which are not allowed as a matter of right within a zoning district, through a public hearing process. A conditional use permit can provide flexibility within a zoning ordinance and often is used by municipal agencies to restrict certain establishments for obtaining a permit to operate a particular business. In this case, this restriction forced organizations to acquire permission to establish treatment centers via conditional ordinance, which involved the introduction and passage of a bill through the city council and mayor—a process that takes 6 months after community approval, which itself can be time consuming. In 2007, the city attempted to ease this regulatory restriction, implementing a "reasonable accommodations" policy that allowed the zoning administrator latitude in approving the location of treatment centers in residential zones without a conditional ordinance or use permit (e.g., waiving the number of unrelated persons who can reside together as a family, thereby allowing small residential treatment facilities to be classified as a makeshift "family").

Although the results of applying the syndemic triangle tool had enabled bSAS and its partner organizations to move strategically in establishing new treatment centers in areas of greatest unmet need, their efforts were stymied by the resistance of area residents backed by the city's exclusionary zoning ordinances. After repeated attempts to negotiate with the city on these issues, the U.S. Department of Justice filed a lawsuit in April 2009 against the City of Baltimore, the mayor, and the city council. The Baltimore City Substance Abuse Directorate, a nonprofit member organization of treatment providers in Baltimore City, filed their own lawsuit against the city in July 2009. The U.S. Department of Justice's lawsuit alleged that the city's zoning code discriminated against individuals receiving treatment in residential substance abuse treatment programs under the Americans with Disabilities Act; the directorate's case alleged a violation of the Americans with Disabilities Act, as well as the Fair Housing Act.⁴⁵

On February 29, 2012, the United States District Court for the District of Maryland ruled that the conditional ordinance requirement was "overbroad and discriminatory."^{46 p.2} The court noted that, in practice, the city had only required a conditional ordinance for treatment

centers that housed 17 or more residents and for smaller facilities that had self-identified as treatment centers. Although the court rejected the argument for discrimination with regard to the larger facilities, it found that the conditional ordinance was discriminatory and burdensome on the smaller treatment providers. The court ordered the city to amend the current zoning code such that the conditional ordinance requirement did not apply to residential programs housing 16 or fewer individuals. The court, however, upheld the city's right to enforce the conditional ordinance for residential programs with more than 16 individuals.⁴⁶ On June 18, 2012, the mayor signed an ordinance to that effect, passed by the city council, into law.⁴⁷

DISCUSSION

Overall, the implementation of the syndemic triangle tool resulted in two key achievements. First, the tool succeeded in providing bSAS with much-needed information for determining priority zones for funding of new treatment centers, according to bSAS's stated criteria. Second, the city residents' opposition to the establishment of new drug treatment centers revealed the need for research on the impact of drug treatment centers on the surrounding community, as well as new strategies for community outreach and education.

bSAS and Triangulating "Syndemic Services"

The syndemic triangle tool provided to bSAS appears to be the first of its kind—a practical, visual tool that can assist citywide decision-making organizations such as bSAS in operationalizing a syndemic approach to unmet drug treatment need. Using this approach, funding can be prioritized for areas where treatment centers are lacking, particularly for areas with both IDU and high HIV transmission risk. bSAS' successful adoption of the tool into its planning and implementation processes provides a clear, evidence-based model of "how the public health system and communities can better respond to syndemics."^{20p.434}

There are, however, limitations and areas for improvement in this tool. As noted, for example, HIV incidence data were only available at the zip code level, because of concerns about the privacy of people living with HIV. Because zip codes are relatively large, heterogeneous, non-population-based units that do not necessarily overlap with neighborhood boundaries, they do not provide targeted information on salient characteristics of communities most affected by the syndemic interactions between HIV, substance use disorders, and IDU. Using more granular data (e.g., HIV incidence at the neighborhood or census tract level) would allow the creation of syndemic triangles that could inform more precise prioritization of areas with high unmet treatment need.

It is also important to recognize that people who left evidence of IDU as measured by the NifETy may not reside where the evidence was observed. Distinguishing between IDU residents of the community, sellers, buyers, visitors, and other "outsiders" merits further research. A Baltimore-based study⁴⁸ found that 92% of respondents who use injection drugs reported doing so in their own homes, whereas 86% reported injecting in friends' homes. Another Baltimore-based study⁴⁹ suggests that location of drug use may vary from place of residence. Reaching conclusions based on the "average" user may be misleading, given

evidence that drug use behaviors and locales can vary by neighborhood, race, and ethnicity. 50–52

The lack of data fuels the debate whether harm reduction and treatment facilities should be located near the areas where people reside, where they inject drugs, or both. Given the push for municipal authorities to exercise data-driven decision-making and setting priorities based on research that supports the claim that geography and distance are barriers to services use, 53,54 this is a crucial subject for future research. Despite the limitations described above, this study makes an important contribution to drug treatment policy by demonstrating how publicly-available data can be used to identify areas with unmet treatment need and inform policy decisions about treatment center placement.

Legal and Policy Ramifications of the Syndemic Triangle Tool

The implementation of the syndemic triangles demonstrates the potential for innovative yet practical drug treatment research to contribute to policy reform. The actions that bSAS took, based in part on our findings, resulted in the city formally rejecting a new drug treatment center. That decision instigated legal action leading to the U.S. district court's ruling against the city's exclusionary zoning ordinance with respect to smaller treatment facilities and the conditional ordinance process. This is a potentially significant win, not only because of the benefits for drug treatment in Baltimore, but also because it serves as a model for similar conflicts over exclusionary zoning in other urban centers.

LESSONS LEARNED AND FUTURE DIRECTIONS

Several key lessons were learned throughout this project. While the primary partnership between bSAS and the researchers was useful in moving this effort forward, a greater cross-section of partners could have been included at the outset to 1) expand the voice and input of additional stakeholders in the entire process and 2) disseminate findings to a broader audience of interested stakeholders who could use the results in meaningful ways. There were several stakeholders who aligned for the subsequent legislation (e.g., University of Maryland School of Law, the Baltimore City Substance Abuse Directorate) that were not included in this project's naissance. There were also important structural variables that were not included in the empirical analysis, including zoning status for locations of identified need. Future work in this area will incorporate zoning into the analytical models, as well as staff from zoning and planning, to help identify feasible regions for service delivery. Last, community residents and persons directly affected by addiction need to be included in this type of work in substantive ways. This will be critical to strike the balance between community members having a voice over services in their communities and persons with substance use disorders having advocacy and ready access to behavioral health services.

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Figure 1.
Visual representation of syndemic triangle calculation.

Figure 2.
Map of block faces with evidence of injection drug use and resultant syndemic triangles.

Table 1.

Areas of Syndemic Triangles as a Measure of Unmet Treatment Need

Zip Code	Degree of Unmet Treatment Need	Syndemic Triangle Area	Scaled HIV Incidence	Scaled Distance	HIV Incidence (per 1,000)
21213	0.18		0.63	0.56	1.873
21218	0.15		0.55	0.54	1.653
21213	0.15		0.63	0.47	1.873
21223	0.12		0.68	0.36	2.031
21206	0.12		0.23	1.00	0.698
21217	0.11		0.79	0.28	2.354
21218	0.11		0.55	0.38	1.653
21213	0.11		0.63	0.34	1.873
21217	0.10		0.79	0.26	2.354
21218	0.10		0.55	0.37	1.653
21218	0.10		0.55	0.36	1.653
21206	0.10		0.23	0.83	0.698
21201	0.09		1.00	0.18	2.981
21218	0.09		0.55	0.33	1.653
21213	0.08		0.63	0.26	1.873
21223	0.08		0.68	0.24	2.031
21217	0.08		0.79	0.20	2.354
21206	0.08		0.23	0.68	0.698

HIV, human immunodeficiency virus.