

Geographic Information Systems (GIS) & HIV Literature Review



Women Living With **HIV** and **AIDS** in **NYC**

A MAPPING PROJECT
AND LITERATURE
REVIEW



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Geographic Information Systems (GIS) allow many different types of data to be geographically viewed, organized and analyzed. This information can be used to make decisions about the allocation of health care and prevention interventions (Rushton, 2003). In the fight against HIV and AIDS, GIS technology has been used in several different ways, including for spatial epidemiology, locating high-risk populations and prevention services, and understanding barriers and access to care among people with HIV and AIDS.

SPATIAL EPIDEMIOLOGY

Spatial epidemiology involves using GIS to locate and track the progression of disease in order to identify epidemiological trends (Rushton, 2003). For example, military doctors at the Walter Reed Army Institute of Research used GIS to map the location of HIV-positive applicants for military service (Bautista, Sateren, Sanchez, Singer, & Scott, 2008). About 4,000 of the 5.7 million people who applied for US military service between 1985 and 2003 tested positive for HIV. The analysis found “significant regional differences in HIV among white and African American applicants;” white HIV-positive applicants came from urban areas in the southern parts of FL, TX and CA, and African American HIV-positive applicants were concentrated in the New York City metro area and parts of the south (Bautista, Sateren, Sanchez, Singer, & Scott, 2008, p. 613). This data reflected the increasing prevalence of HIV in the south and the impact of the disease on African Americans, who comprised 66% of the positive applicants. Scribner et al. (2008) used GIS to map HIV cases in New Orleans by risk category, including men who have sex with men (MSM), intravenous drug users (IDU), and high risk heterosexuals (HRH). The maps revealed the location of a core group, or “bull’s eye,” for each of these three high risk populations (Scribner et al., 2008, p. 204). Law et al (2004) created similar maps that identified core areas of sexually transmitted disease in North Carolina. In addition to these spatial methods, Scribner et al. (2008) used standard statistical analysis to test if these individuals’ common location could be explained by socio-demographic characteristics. They found that the spatial location of the IDUs and HRHs with HIV

The HIV Prevention Services [GIS] Database can be used to inform decisions about prevention services and their spatial relationships to each other and to high risk communities.

was explained largely by other variables or “shared social structures,” but location was significant for the MSMs, even after controlling for these other factors (Scribner et al., 2008, p. 212). These results suggest that for MSM in New Orleans, place, in and of itself, can elevate HIV risk.

PREVENTION: LOCATING HIGH RISK POPULATIONS

GIS has also been used to locate individuals who are at risk for HIV in order to make decisions about prevention services. For example, information collected from sex workers in Kenya was used to create GIS maps that identified truck stops with high volume of transactional sex (Ferguson & Morris, 2007). In Chicago, GIS was used to map the location of young black MSM and *HIV prevention services* tailored to MSM (Pierce, Miller, Morales, & Forney, 2007). These Chicago maps identified parts of the city where young black MSM were underserved. Researchers in Vancouver interviewed street-based sex workers about where they lived and worked, where they accessed syringes and health services and which areas they avoided because of concerns about personal safety and police harassment (Shannon et al., 2008). In answering these questions, the participants were asked to identify specific street sections or corners. GIS spatial analysis of this data found “significant geographic correlation between the health service and syringe availability core...and physical settings avoided due to violence and policing” (Shannon et al., 2008, p.143). Further statistical analysis found that this relationship between the service availability core and areas of avoidance was strongest for Aboriginal women, young women, and heavy drug users. This study suggests the need to provide more prevention services via mobile units in the perimeter areas where women work to decrease their risk of violence and harassment (Shannon et al., 2008).

Between 2001 and 2006, a multi-site US study about high-risk youth used “GIS-produced maps to determine a neighborhood and population of focus, recruit appropriate community partners...examine geographic and neighborhood characteristics that may contribute to HIV infection rates, and garner community support for the project’s objectives” (Geanuracos et al., 2007, p.1974). Each of the 15 sites mapped the rates of STDs (including HIV) among people aged 12 to 24 (by gender, race and year), homicide, and socio-economic census data (e.g. people living below the poverty line, female-headed households, high school graduates). Some maps reflected a single variable, while others overlaid more than one risk factor. This information was used to reach community consensus about this population’s most pressing service needs and design and target interventions accordingly (Geanuracos et al., 2007; Ziff et al., 2006).



ACCESS TO HIV/AIDS CARE

Finally, GIS has been used to map the number of HIV services in a given area in order to understand access to prevention and health care (McLafferty, 2003). The US Centers for Disease Control and Prevention (CDC) led a major initiative between 2000 and 2002 to map all the community-based organizations providing CDC-funded prevention services (Hanchette, Gibbs, Gilliam, Fogarty, & Bruhn, 2005). The CDC collected data about the location of these programs and their geographic service area(s). The resulting *HIV Prevention Services [GIS] Database* can be used to inform decisions about prevention services by describing their spatial relationships to each other and to high risk communities (Hanchette, Gibbs, Gilliam, Fogarty, & Bruhn, 2005). A similar GIS project was undertaken in Toronto, Canada (Fulcher & Kaukinen, 2005). The researchers mapped five categories of HIV service providers and found that emergency and prevention services were clustered together in one part of the city while medical and end-of-life services were more evenly distributed. The distance from the center of each census tract to the nearest HIV related service was also calculated in order to identify underserved areas of the city.

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