



Contents lists available at ScienceDirect

Journal of Criminal Justice



Using GIS to evaluate post-release prisoner services in Newark, New Jersey

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ARTICLE INFO

Available online xxx

ABSTRACT

Discharge planning is increasingly prioritized by correctional systems in order to prepare prisoners for their reintegration into society. A goal of discharge planning is to link prisoners with appropriate service providers in the community to meet their needs. A successful discharge plan requires that an optimal level of services exist and work in a coordinated and collaborative way in order to ensure a continuum of care and treatment during the reentry process (Queralt & Witte, 1999). This study utilized Geographic Information System (GIS) to assess the size, demographic characteristics, and needs of the Newark, New Jersey parolee population with the availability, location, and characteristics of health and human service agencies servicing their needs. A random sample of parolees (N=800) released in 2006 was selected for this study. Social service agency data were obtained from an on-line service agency data base. Results of the analysis include the degree of spatial distribution, accessibility, and availability of services to where the parolees live and the degree of spatial overlap of specific services in an area.

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Introduction

The necessity for post-prison release needs-based services assumes greater importance as the number of offenders being released from prison to the community continues to increase at both the national and state level. Nationally, nearly 700,000 prisoners are released annually from prison to the community (Sabol, Minton, & Harrison, 2007). At the time of release, offenders return to their communities with a variety of needs and problems that, if not properly addressed, may significantly impact their ability to remain crime free. These problems run the gambit from needing to locate secure housing, to finding employment, to obtaining health care, and in many instances, to addressing ongoing treatment for substance abuse, mental illness, and/or chronic or communicable diseases. Empirical research shows that 80 percent of offenders used drugs prior to their arrest, that more than half of prisoners have some sort of mental health problem, that 19 percent of offenders are illiterate and 40 percent of prisoners are functionally illiterate, that 31 percent of offenders were unemployed prior to arrest, that nearly 3 percent of prisoners have HIV/AIDS, and that 18 percent are infected with hepatitis C (James & Glaze, 2006; National Commission on Correctional Health Care, 2002; Petersilia, 2003).

This study assessed the distribution, availability, and accessibility of post-release community-based social service facilities in an urban area—Newark, New Jersey in order to gain more insight into the spatial logistics associated with providing services to reentering prisoners as well as the context within which service allocation and utilization occurs. The hy-

pothesis is that parolees were overrepresented in certain areas of Newark and that their needs were not being optimally met because the spatial distribution of these services did not adequately match parolees' geographic distribution. As Hombs (1998) noted, without concrete resources and the knowledge of these resources, "discharge planning is illusory." Moreover, research by Robertson and Wier (1998) indicated that staff members such as parole officers became more knowledgeable and thereby more effective and efficient in referring clients to services and treatment when their case loads were concentrated in one geographic area. Consequently, one could argue that an assessment of the spatial accessibility of social services based on where parolees live, coupled with an analysis of the geographic distribution of parole officers' case loads is relevant to any discussion of direct or indirect service delivery, the results of which could drastically impact parole practice.

To that end, this study had five objectives: (1) to identify the spatial distribution of social services between where parolees live and the location of these services, (2) to identify the logistical aspect of service accessibility via public buses, (3) to identify the degree of spatial overlap of specific types of services, (4) to identify the proximity of parolee residences to the parole district office, and (5) to identify the degree of spatial distribution and overlap among parole officer case loads.

Literature review

Prior research about service utilization

A primary purpose of discharge planning and post-release parole supervision is to establish and prioritize needs and to link prisoners

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with appropriate community service providers that attempt to meet these needs. Ultimately, a successful discharge plan requires that an optimal level of services exist and work in a coordinated and collaborative way in order to ensure a continuum of care and treatment during the reentry process (Queralt & Witte, 1999). Once a discharge plan has been developed and the services necessary to meet offenders' needs have been targeted, an analysis of the availability and accessibility of these services in the community must be determined. Unfortunately, even when prisoners' needs are enumerated, research finds that service utilization is complex—based on individual, social, and system level factors (Strike, Rhodes, Bergmans, & Links, 2006). A dearth of information in the criminal justice field has been written on service utilization. One can look in the public health literature, however, for multifaceted models which explain the barriers to service use. Anderson's (1995) behavioral model of service utilization, for example, one of the most widely used in the health care field, specified three factors to predict the use of services in a community: predisposing factors (i.e., socio-demographic characteristics of an individual), enabling factors (i.e., logistical aspect of service utilization), and needs factors (i.e., the perceived and real needs of individuals). The scope of this study was focused primarily on the enabling factor.

The logistical aspect of service utilization (i.e., the enabling factor) can be operationalized in several ways. The availability approach emphasizes determining the total number of services in a geographic area, often at the neighborhood, community, or city level (Fulcher & Kaukinen, 2005). An alternative approach is to measure the services' accessibility, the distance from point A (home address) to point B (service) (Booth, Staton, & Leukefeld, 2001). In this instance, travel time and transportation resources should be taken into consideration because even a relatively short distance may take a great deal of time if one does not have an automobile or must rely on public transportation (Farley, 2004; Zenk, Tarlov, & Sun, 2006).

Service providers often argue that service utilization may not diminish if services are outside a client's locality, and in addition, there may be some positive aspects in having a person travel outside their comfort zone for services (New York City Department of Health and Mental Hygiene, 2006). Their argument follows: (1) clients will travel to services regardless of where they live, particularly in urban areas with strong public transportation infrastructures, (2) going to services in high crime areas may be counter-productive (e.g., drug dealers working outside an addiction clinic), (3) qualified employees do not want to work in high crime areas, and (4) there is an increased potential for stigmatization by attending services where everyone knows who you are.

Some of these contentions are supported depending on the type of service. A major barrier for HIV testing, for instance, is the fear, particularly in small communities that confidentiality will be compromised because everybody knows everyone else's business (Mizan & Ford, 2005). High crime rate communities also have problems attracting businesses, recruiting, and retaining employees and volunteers which can adversely affect an offender's rehabilitation (Dickey, 2003; New York City Department of City Planning, 1993). The problem of selling illegal drugs outside of drug treatment centers became such a problem in Washington, D.C. that it prompted the House Judiciary Committee to order an investigation. The final report was aptly titled *Illegal Drug Activities Near Some District of Columbia Clinics Undermine Clinic Services and Patient Rehabilitation* (Cramer, 2004).

Public health research regularly finds an association between the spatial distribution (or mismatch) of clients to services and decreased utilization of these services, in both rural and urban areas (e.g., Anderson, 1995; Farley, 2004; Fulcher & Kaukinen, 2005; Nemet & Bailey, 2000; United States General Accounting Office, 1995; Vander-Waal et al., 2001; Zenk et al., 2006). Although services in urban areas would seem to be far more available compared to rural communities, proximity alone does not facilitate or predict use. Nemet and Bailey (2000, p. 1204), in their research on health service use, argued that the

“experience of place is a more valuable indicator of utilization than is distance which separates individuals and their physicians.” Shannon and Spurlock's (1976) research of lower socioeconomic families in Washington, D.C. found that their activity space varied by type of activity, with more people willing to travel outside their comfort zone for medical needs, compared to leisure time activities or work. This research also noted a great deal of variability in activity space at the individual level for people living in the same community (1976). Recent unpublished research by Kennedy supported this intra-variability of activity space, noting that some gang members were very adept at leaving the community, while others were not (D. Kennedy, personal communications, 2006).

Parole officers as service brokers

Recent research has evaluated the primacy of boundary spanners as yet another critical component in coordinating services, treatment, and discharge plans with the offender population (Pettus & Severson, 2006). While parole officers may not be commonly thought of as boundary spanners in the traditional sense, in many ways they do perform most of the responsibilities of a boundary spanner and are in an ideal position to “facilitate communication across agencies and professions to coordinate policies and services” (Conly, 1999). Albeit, this depends upon where along the casework-surveillance continuum the parole officer or parole agency falls. Taxman (2002) and Seiter and West (2003) suggested that the casework approach to parole practice emphasizes treatment and rehabilitation, and that this approach encourages the officer to assist offenders with problems and counseling and to work with offenders to maximize the likelihood that they will successfully complete parole. Conversely, the surveillance approach to parole emphasizes employing tactics to monitor offenders (i.e., drug testing, electronic monitoring) and to enforce compliance, focusing on technical violations of the conditions of probation or parole (Seiter & West, 2003).

Difficulties arise when parole officers attempt to reconcile these sometimes competing objectives (Caplan, 2006; Seiter & West, 2003), even though the research indicates that a reconciliation of these sometimes competing objectives or job orientations is critical to effectively managing offenders and reducing recidivism. Petersilia (2003) suggested that parole practices that are primarily surveillance-oriented were not likely to achieve as favorable outcomes as community corrections practices that balance or integrate surveillance and casework activities. Scholarship by Paparozzi and Gendreau (2005) further supported this contention. Results comparing recidivism rates of Intensive Supervision and Surveillance Program (ISSP) participants by ISSP officer orientation indicated that a balanced job orientation was significantly more likely to reduce recidivism compared with officers who utilized a law enforcement- or social work-only job orientation (Paparozzi & Gendreau, 2005).

Parole officers employ a unique set of skills that enable them to provide a service both to parolees (i.e., in brokering services and treatment) and to the community at large (i.e., attempting to maintain public safety). Parole officers often act as the primary conduit by which parolees obtain information about available services in the communities in which they live. Parole officers often work with local businesses and other community-based organizations to coordinate viable job opportunities and service and treatment options, as well as to identify gaps in resource provision and functional capacity. Furthermore, parole officers provide parolees with a ‘road map’ or case management/discharge plan that can ultimately assist in the reintegration process. In these ways, parole officers act not only as direct service providers but also as service brokers, referring parolees to appropriate service and treatment programs in a community setting when necessary and appropriate (Taxman, 2002).

Certainly, the research evaluating the role of boundary spanners suggests that parole officers may well provide direct service delivery

in other ways, such as acting as a liaison between and within agencies and organizations in an effort to encourage and promote more effective and efficient service provision and utilization (Pettus & Severson, 2006). Ultimately, parole officers and paroling agencies are in a unique position to bring together disparate stakeholders in an effort to work toward a continuum of service that incorporates elements of case management and service provision with effective supervision strategies that transcend traditional boundaries. Existing studies, however, have not heretofore evaluated or cast parole in this light. Studies also have not evaluated the spatial distribution and overlap of parolees, services, and parole officer case loads. To date, the bulk of the research on parole has evaluated parole officers with respect to role conflict and job orientation (Ohlin, Pivin, & Pappenfort, 1956; Sigler, 1988; West & Seiter, 2004), with role conflict and job orientation defined in terms of the casework-surveillance continuum (West & Seiter, 2004).

In 2004, for example, Brown (p. 97) incorporated the “expert” model in his research when he interviewed seventy-four parole officers and asked: “What do offenders need to succeed in the first 90 days after release?” Using a cluster analysis technique, Brown grouped the parole officers’ responses into the following seven clusters: (1) basic supplies (e.g., transportation, identification, food, and medication), (2) life skills (e.g., list of AA meetings, mental health services), (3) education and employment (e.g., job placement services), (4) corrections programs (e.g., relapse prevention programs), (5) insight into problems (e.g., conflict resolution skills), (6) preparation for community supervision (e.g., understanding, flexible parole officer), and (7) structure (e.g., close monitoring). Unique about Brown’s research was the finding that parole officers not only placed the burden of reentry on the parolees, but also emphasized the importance of having a close working relationship between service agencies and parole officers.

Methods

Data and sampling

The data used in this analysis were derived from multiple sources. First, an inventory of health and human service agencies was developed using an action research model to best develop the knowledge of specific resources needed for prisoners returning to the Newark area. French and Bell (1995, p. 140) defined action research as “the application of the scientific method of fact-finding and experimentation to practical problems requiring action solutions and involving the collaboration and cooperation of scientists, practitioners, and layperson.” Thus, action research argues that change comes about when all parties, not just the scientists, define the problem, determine how to go about collecting the information, and assess the outcomes (French & Bell, 1995).

Fishman and Mellow (2005) surveyed stakeholders and ex-prisoners regarding their needs upon release. Realizing that prison social workers, offenders, parole officers, and community agency personnel had a wealth of knowledge about the services that work and those that do not, representatives from these groups were contacted in a formal and informal way to understand what post-release health and human services were needed. Five focus groups were conducted to determine the health and human service needs of offenders returning to the community. The first focus group was a meeting of parolees, ex-prisoners, and community representatives sponsored by the Police Institute at Rutgers-Newark. The participants were especially interested in issues related to job training and placement, obtaining identification, finding funds, where to go for health care and substance abuse, transportation, and psychological needs.

The second focus group was conducted with twelve recently released prisoners. Housing and employment issues were the primary topics this group was interested in discussing. The third focus group was held at a community-based organization in Newark with a self-

help center for prisoners and ex-prisoners. Approximately twenty ex-offenders were at the meeting. Another meeting was held at a residential drug treatment facility where drug counselors, social workers, and clients discussed the needs of returning offenders. Finally, a group of ten female parolees was interviewed about their needs. Issues of child care, HIV/AIDS, housing, and employment were all mentioned.

After the assessment of the needs of prisoners returning to the community was conducted, an inventory was compiled of all the post-release health and human services in the Newark metropolitan area that were available and willing to work with offenders. Each agency was contacted by phone or in person to verify their willingness to work with those recently released. Agencies who were not interested in working with ex-prisoners were not listed in the data base. A food kitchen, for example, requested that they not be listed in any prisoner reentry data base or publication because the community where they were located was opposed to having the formerly incarcerated in the area. The health and human service data base developed by Prisoners Self Help Legal Clinic and The Prisoners and their Families Project was used as the primary data source for social service facilities and the types of services provided. This data base had a total of 453 agencies and programs. Additional information developed for the *Essex County Smart Book: A Resource Guide for Going Home* (Fishman & Mellow, 2005) was also used. Specific information included in this data base was: agency name, address, zip code, phone number, e-mail address, fax number, Web site, hours and days of operation, services provided (e.g., comprehensive, housing, employment, substance abuse), eligibility requirements, documents required, fees, and languages spoken.

In 2005, approximately 18,000 offenders were released from New Jersey prisons either upon completion of a sentence or for parole supervision (New Jersey Department of Corrections, 2006). Department of Corrections data indicated that approximately 16 percent or 2,880 offenders released from prison to the community in New Jersey resided in Essex County, the county in which Newark is located (New Jersey Department of Corrections). Data for this analysis were obtained from a sampling frame of 13,973 offenders on active parole supervision in New Jersey as of February 2006. Excluding cases with missing data, the valid yield was 11,107 cases. Of those, approximately 1,159 offenders had zip codes identified by the U.S. Postal Service as being located in Newark. A random sample of 560 cases was selected from these Newark parolees for analysis. For each of these cases, the following information was collected: block-level addresses, demographic data (i.e., date of birth, gender, race/ethnicity), the parole district office to which the offender was assigned, the parole officer to whom the offender was assigned, current parole status, sentence length, sentence type, month and year of admission to the New Jersey Department of Corrections, month and year of release from the New Jersey Department of Corrections, parole violations, and probation violations.

Data were acquired from both the Parole Board Information System and individual parolee case files. In order to meet the requirements of the Institutional Review Board, the data analyst from the New Jersey State Parole Board assigned random identification numbers to all offenders on active parole supervision from which the random sample was drawn. Address information for all offenders in the sample was provided at the block level—by removing the last numeral of the street address—in order to not disclose the precise location of where offenders lived. In this way, a more substantial measure of privacy was afforded to these parolees.

Using ArcView geographic information system (GIS) software, addresses of 560 parolees and one parole district office were geocoded to produce coordinates that were mapped and analyzed. Sixteen parolee addresses (3 percent) could not be geocoded due to incomplete address information, and were discarded. As a result, the final sample of parolees in this study was 544, or 97 percent of the observations that comprised the initial sample.

Table 1
Selected descriptive statistics for New Jersey inmates and parolees

	New Jersey prison population (N=18,624)*	New Jersey parole population (N=13,972)	Sample (n = 560)
Age (in years)	33	38	36
Gender (percent)			
Male	94.1	87.0	91.2
Female	6.0	7.0	8.0
Ethnicity (percent)			
White	18.9	22.2	4.4
African American	62.8	46.1	77.0
Latino	17.8	16.3	17.1
Median sentence length (in years)	5	-	5
Parole violation ever?			
No	-	-	87.2
Yes			7.3
Probation violation ever?			
No			77.6
Yes	-	-	17.0
Ever previously incarcerated?			
No	-	-	50.4
Yes			40.2

Note: May not equal 100 percent due to rounding or missing cases.
*New Jersey Department of Corrections (2006).

GIS analysis methods

ArcView is a full-featured software package that is widely used for visualizing, managing, creating, and analyzing spatial data. Mapping the spatial distribution of where parolees live to the geographic location of health and human service agencies with GIS software enables a visual and statistical analysis of the distribution and overlap of social service facilities (Karuppannan, 2005). As Orford, Harris, and Doring (1999, p. 4) stated, GIS is “very effective in the analysis and presentation of complex data.” Using ArcView 9.1, buffers, pin (point) maps, and density maps were created to better understand the spatial context of parolees and social services. The Crime Analysis Spatial

Extension (CASE), which was developed by the National Institute of Justice for the Mapping and Analysis for Public Safety Program, was used in this analysis in addition to the basic analytical and display functions that come with ArcView software (National Law Enforcement and Corrections Technology Center [NLECTC], 2005). CASE was released in January 2005 and contains several crime analysis tools that were originally created by the United States Geological Survey’s Alaskan Biological Science Center to study animal movements. CASE improved the mathematical rigor of the analysis by using well-known and thoroughly documented tests such as Nearest Neighbor (NN) cluster analysis, standard deviation ellipses, spider diagrams, and minimum convex polygons.

The following four GIS methods were used for this analysis. Density mapping expresses the distribution of point values over a surface without limiting the analysis to census tracts or other geo-political boundaries which can introduce aggregation errors and systematic biases (Chainey & Ratcliffe, 2005; Metraux, Caplan, Klugman, & Hadley, 2007). Density maps also represent the rawest measure of local concentration, as densities are calculated without taking into account contextual factors such as general population density or poverty levels. Instead, the density calculations spread point values over a surface by dividing an output map into equally sized cells and then applying a circular search area to each cell in which the number of point values determines the density value for each cell. A density map is then created, where progressively darker shades of color represent areas with heavier densities. Kernel density calculations were used to determine the degree of density for parolees and social services in Newark. Kernel density is similar to a simple density calculation, in which points (e.g., address locations) that fall within a search area are summed and then divided by the search area size to get each cell’s density value. In a Kernel density algorithm, however, points lying near the center of a cell’s search area are weighted more heavily than those lying near the edge, in effect smoothing the distribution of values.

The Nearest Neighbor (NN) analysis works by calculating the distance from each point in a collection to its nearest neighboring point (NLECTC, 2005). The mean NN distance for the whole collection is calculated, as well as the standard deviation. This distance can then be

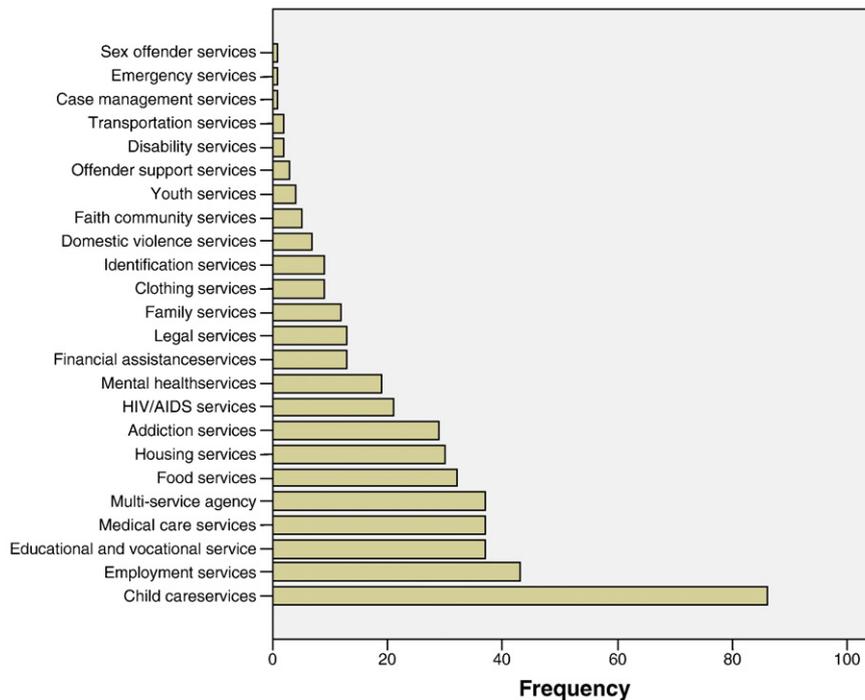
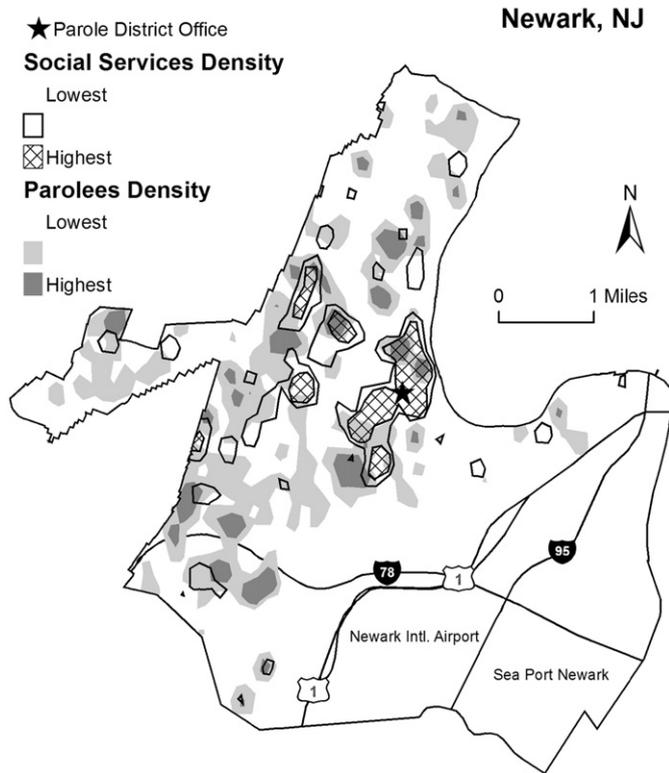


Fig. 1. Frequency of Newark, New Jersey services by service type (N=453 programs).



Map 1.

compared to the expected mean NN distance for a random distribution. By comparing the observed mean NN distance to the expected, one can tell if the points are significantly randomly distributed or clustered.

A standard deviation ellipse is a technique used to measure central tendency (NLECTC, 2005). The method begins by deriving a least squares trend line across a distribution of points. It then calculates the mean X and Y coordinates, and derives standard deviations from the error against the trend line. Standard deviation distances were used to define the outer bounds of a smoothed ellipse polygon, which was displayed on a map and used for additional GIS analyses.

Spider diagrams are drawn by connecting a group of points to their arithmetic centers with straight lines (NLECTC, 2005). The resulting radial diagram helps describe the relationship of points to their center and enables the study of distances from the center to each point.

Minimum convex polygon (MCP) is a technique that draws a bounding polygon around point locations so that the outlying points serve as vertices for the polygon (NLECTC, 2005). These polygons can be imagined as a rubber band stretched around the points and represent the minimum perimeter that contains every point.

Results

Before an in-depth analysis evaluating the spatial distribution, accessibility, and overlap of services for parolees was conducted, it was deemed important to determine the extent to which the sample selected for this analysis and the larger parole and inmate populations for the state of New Jersey were similar. Unfortunately, direct comparisons between the sample and the overall parole and inmate population for some key variables was not possible because much of the detailed data collected for the study sample was provided by the State Parole Board directly from offender case files. Furthermore, detailed statistical comparisons among groups were not possible because the data obtained on New Jersey's inmate population were derived from a published report.

Table 1 indicates that the study sample differed from the larger parolee and inmate population with respect to age, gender, and ethni-

city. Offenders included in this sample tended to be younger, were more likely to be male, and were more likely to be African American than their counterparts in prison or on parole statewide. With respect to age, differences were noted between the overall inmate and parolee populations and between the parolee population and this sample. Gender differences, while apparent, were likely insignificant.

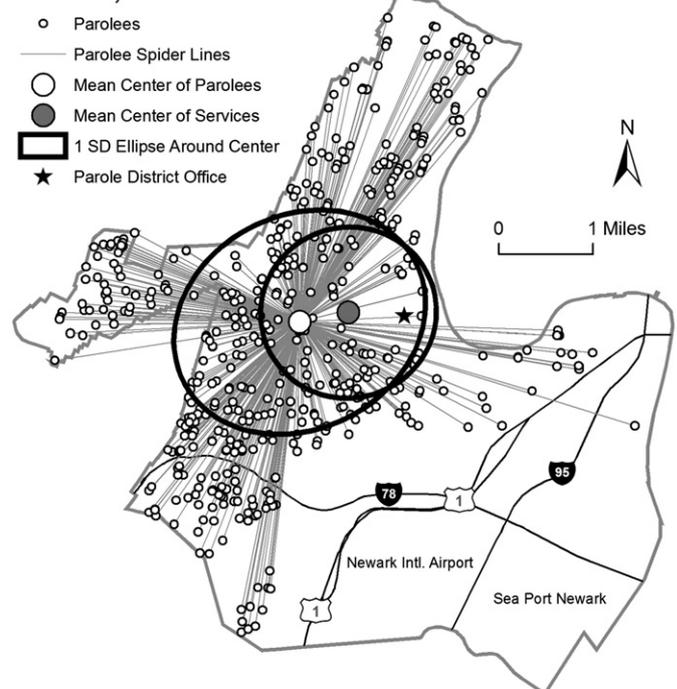
The percentage of Whites, African American, and Latino people residing in Newark in 2000 was 21.9 percent, 52.7 percent, and 32.9 percent respectively, compared with 74.7 percent, 12.1 percent, and 14.5 percent respectively, nationwide (United States Census Bureau, 2006). This study had a disproportionate number of African American parolees, which was to be expected given the demographic characteristics common to the overall prison population. The median sentence length for New Jersey inmates and this sample was identical at five years. Moreover, data indicated that just over 50 percent of offenders in this sample had been previously incarcerated and that nearly 87 percent of parolees had never previously incurred a parole violation.

Spatial distribution, accessibility, and overlap of social services

Many types of social and human services existed for offenders returning to Newark, including child care, employment, medical care, food, housing, addiction services, and mental health services. In all, 453 programs (some of which were multi-service programs) were geocoded and mapped at 373 addresses (Fig. 1). Fig. 1 indicates how the relative availability of services varies by service type. Only one sex offender service, for instance, was self-identified as willing to work with ex-prisoners, compared to forty-two employment services. All child care services contacted were willing to work with the children of ex-offenders.

Map 1 displays overlapping densities of parolee residences and social service facilities. Symbology representing the "highest" density category signifies areas in which the concentration of parolees or services, respectively, is greater than positive three standard deviations from the mean density in all other parts of Newark. The "lowest" symbology category represents density values less than positive one standard

Mean Centers of Parolees and Services in Newark, NJ



Map 2.

Table 2
Frequency and percent of parolees and four service types by Newark, New Jersey zip codes

Newark zipcode	Parolees		Addiction services		Employment services		HIV/AIDS services		Housing services	
07101	0	0.0%	1	4.8%	0	0.0%	0	0.0%	0	0.0%
07102	53	9.4%	10	47.6%	17	51.5%	7	36.8%	8	34.8%
07103	82	14.6%	4	19.0%	5	15.2%	4	21.1%	9	39.1%
07104	81	14.4%	0	0.0%	3	9.1%	1	5.3%	1	4.3%
07105	29	5.2%	3	14.3%	0	0.0%	1	5.3%	1	4.3%
07106	57	10.1%	0	0.0%	1	3.0%	0	0.0%	0	0.0%
07107	75	13.3%	1	4.8%	5	15.2%	5	26.3%	3	13.0%
07108	80	14.2%	1	4.8%	1	3.0%	0	0.0%	1	4.3%
07112	74	13.2%	0	0.0%	1	3.0%	1	5.3%	0	0.0%
07114	29	5.2%	1	4.8%	0	0.0%	0	0.0%	0	0.0%
Total	560	100.0%	21	100.0%	33	100.0%	19	100.0%	23	100.0%

deviation; the middle (unlabeled) category represents density values between positive one and positive three standard deviations.

While parolees may live on any piece of land in Newark (with the exclusion of Newark International Airport or the seaport), a higher concentration of parolees in the study sample lived in the shaded grey areas on the map; a higher concentration of social services were located within the black outlines and crosshatched areas on the map. Layering these two density maps together, as shown in Map 1, allowed for a visual analysis of the spatial overlap of parolee residences and social services. The parole district office for Newark was included as a point of reference and is symbolized with a star on the map. Geographic areas with higher densities of social services do not appear to comprehensively overlap with areas comprised of higher densities of parolee residences. As Map 1 illustrates, there is an apparent spatial mismatch between most parolee residences and most social services. The majority of services are clustered in the city center of Newark where the parole district office is located. In comparison, parolees are not residing only in this area; instead, they are predominantly living in areas outside of the city center. Map 1 also identifies several areas of Newark with high densities of parolee residences but relatively few or no social services.

Map 2 shows the arithmetic mean centers of parolee residences and social service facility locations in Newark. Spider diagrams are used to provide a visual point of reference for the centroids around which parolees and services are located and to compare the proximal relationship of these central points. Ideally, one might expect these centroids to overlap perfectly—signifying that social service facilities are clustered around the same center about which parolee residences are located. These points are 2,785 feet or approximately one-half of a mile apart. The average distance about which parolees and service facilities are located from their aggregated centers is 8,471 feet (SD=4,145 feet) and 5,750 (SD=3,741), respectively.

Ellipses showing one standard deviation from the mean centers of parolee residences and service facilities are symbolized as thick black lines in Map 2. Two hundred nine parolees actually reside within one standard deviation from the (parolee) study sample's center; however, 262 (70 percent) social service facilities are located within this same area. These facilities represent at least one of every type of service including youth, transportation, mental health and medical care, legal, identification, housing, HIV/AIDS, food, financial, family, faith, employment, educational, domestic violence, disability, clothing, child care, and addiction services. Two hundred seventeen service facilities are located within one standard deviation from their aggregate center; 113 (21 percent) parolees are located within this same area. The Newark parole district office is located within both ellipses.

In the aggregate, social service facilities are dispersed throughout most hospitable parts of Newark (the airport and sea port are exceptions; see also Table 2). It was hypothesized that while social service facilities available to parolees are located in most parts of Newark, each of the nineteen types of services would also be uniformly distributed

throughout the city; that is, they would not be clustered together. For example, northern parts of Newark should, ideally, have a variety of services (e.g., legal, food, and housing) while southern parts of Newark should also have a similar variety of services. Put another way, it was reasoned that the locations of service facilities providing similar service activities would not be clustered together. This was not the case.

Separate Nearest Neighbor (NN) analyses were performed on the groups of points that represented the same type of service. For example, all “legal services” were tested to see if facilities that provide legal services are spatially clustered together within Newark. Table 3 presents the statistical output of the NN analysis. Negative z scores indicate a clustered distribution, positive z scores indicate a uniform distribution, and z scores near zero indicate a random distribution. Nearest Neighbor analyses found the locations of similar types of services to be significantly spatially clustered amongst themselves. That is, mental health services for instance were not uniformly distributed throughout Newark. Instead, facilities in Newark that provide mental health services were clustered together within a similar area of the city. That was the case for each type of social service in the sample.

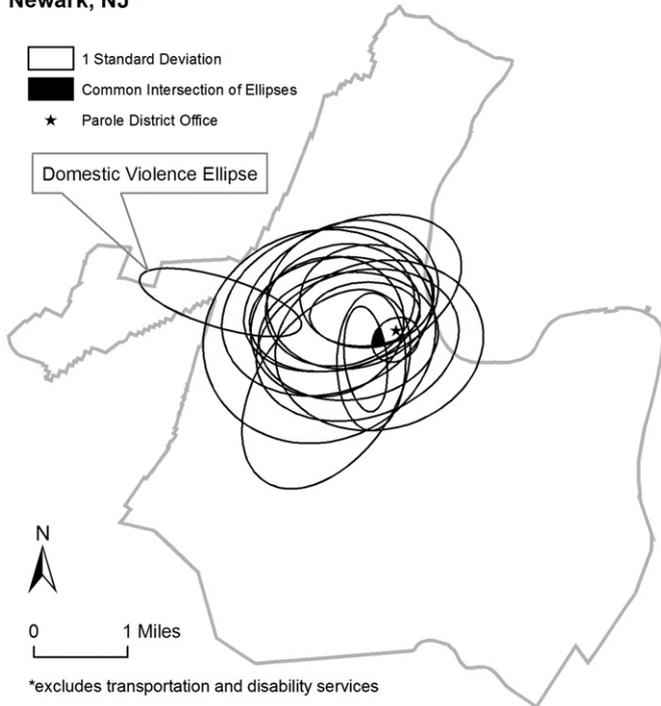
Standard deviation ellipses provided further visual and statistical support for the conclusion reached by the NN analysis. Map 3 shows ellipses representing one standard deviation from the arithmetic mean center of service facility locations—for seventeen different types of social service activities.¹ Statistically, it can be expected that a majority of facilities that provide a particular type of service are located within each respective ellipse. As depicted in Map 3, ellipses

Table 3
Separate nearest neighbor (NN) analyses

Service type	n	R	Mean NN distance	Expected mean NN distance	S. D.	Z
All services	373	.17	232.39	1340.26	391.12	-30.54*
Youth	4	.36	4634.06	12942.32	3681.75	-2.46*
Mental health	15	.39	2599.30	6683.38	3254.21	-4.53*
Medical care	22	.46	2546.38	5518.62	3430.16	-4.83*
Legal	13	.09	626.32	7179.11	777.59	-6.30*
Identification	7	.20	1987.07	9783.47	2347.61	-4.03*
Housing	23	.22	1223.06	5397.32	1874.34	-7.10*
HIV/AIDS	19	.29	1730.21	5938.34	2736.14	-5.91*
Food	27	.24	1192.77	4981.50	1361.45	-7.56*
Financial	10	.45	3674.22	8185.44	4091.46	-3.33*
Family	10	.15	1257.90	8185.44	1210.30	-5.12*
Faith	5	.14	1589.83	11575.96	2277.98	-3.69*
Employment	33	.39	1761.26	4505.94	2313.30	-6.69*
Educational	30	.24	1131.97	4725.87	1598.27	-7.97*
Domestic violence	5	.01	146.15	11575.96	200.13	-4.22*
Clothing	7	.19	1900.92	9783.47	1618.92	-4.08*
Child care	81	.38	1085.63	2876.07	676.08	-10.72*
Addiction	20	.25	1455.81	5787.98	2333.68	-6.40*

Note: Transportation and disability services were excluded because each had less than three points.
* p<0.05.

Standard Deviation Ellipses for Each Type of Social Service in Newark, NJ*



Map 3.

(i.e., clusters) of each type of service appear to be overlapping with ellipses of other types of services. This produces, in effect, a common area within Newark in which many different types of services are available to parolees, but in which other parts of the city are either deprived of any services or are deprived of a wide variety of different types of services. This suggests that when a parolee lives in an area with a lot of educational services, for instance, that area is likely to also have a lot of other differing types of services, as well as many other educational services. Similarly, parolees residing in other areas of Newark are not likely to have educational or any other types of services nearby.

Most types of social service activities appear to be provided by facilities that are located in the center of Newark. This is consistent with information gathered from Maps 1 and 2. Furthermore, less than 0.19 square miles within Newark share a common intersection among the standard deviation ellipses, as symbolized by the small, black shaded area in Map 3. Fifteen out of seventeen ellipses contain the parole district office, which means that the parole district office is within one standard deviation away from the center of the cluster of these types of services. Faith services and domestic violence services are the exceptions.

The locations of all public transportation bus stops in Newark were geo-coded and mapped to better understand how accessible parolees and services are to each other—based upon this public means of conveyance. Buffers were drawn around each bus stop at distances of 500 feet and 1,000 feet. Five hundred feet is the average length of one Newark city block and was considered to be a reasonable distance for parolees to walk to catch a bus. Points representing parolee residences and social service facilities, respectively, were queried by spatial location to determine how many of each was located within these buffers. Sixty-three percent (343) of parolees in the study sample were within 500 feet of a bus stop and 93 percent (505) were within 1,000 feet. Eighty-four percent (314) of social service facilities in the study sample were within 500 feet of a bus stop, including the parole district office which is less than 150 feet. Ninety-nine percent (369) of social service facilities were within 1,000 feet of a bus stop. Although

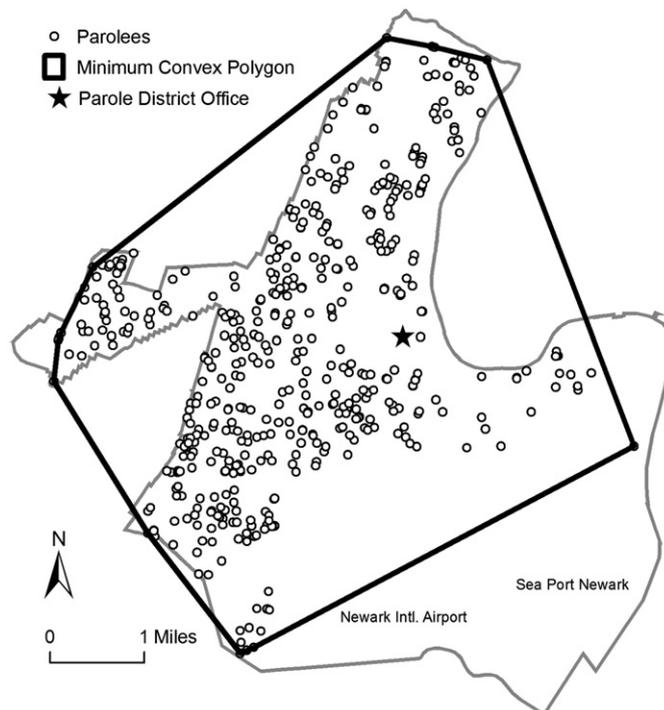
bus routes were not assessed for this study, multiple bus stops are located throughout most of the city. In fact, the 1,000 foot buffer covers 62 percent of the city's surface area, and if the airport and seaport areas of Newark are not counted, that percentage would be significantly higher since their surface areas account for much of the remaining 38 percent. It is apparent from the buffer analysis that parolee residences and social service facilities (including the parole district office) are mutually accessible based upon their proximities to public bus stops.

Parole officer case load distribution

In order to evaluate parole officer case load distributions, a subgroup analysis was conducted by randomly selecting six parole officers' case loads from the Newark parole district office. To do this, a random number was generated for every parolee using Microsoft Excel. Then, the random numbers were sorted in ascending order by officer. Parolee case loads for the first three different officers were selected for inclusion in the analysis. The authors worked under the assumption that since officer case loads vary in size, officers with the largest case loads would have a better probability of having one of their parolees randomly assigned a number that was low, and therefore, sorted at the top of the list. This assumption turned out to be correct because the first three officer case loads selected for mapping—A, B, and C—were comprised of twenty-four, twenty-four, and eighteen parolees, respectively (accurately representing approximately 48 percent of the total case load that these officers regularly carry). To further validate the results, three parole officers from the bottom of the sorted random number list were also analyzed. These case loads—D, E, and F—were comprised of eight, nine, and eleven parolees, respectively.

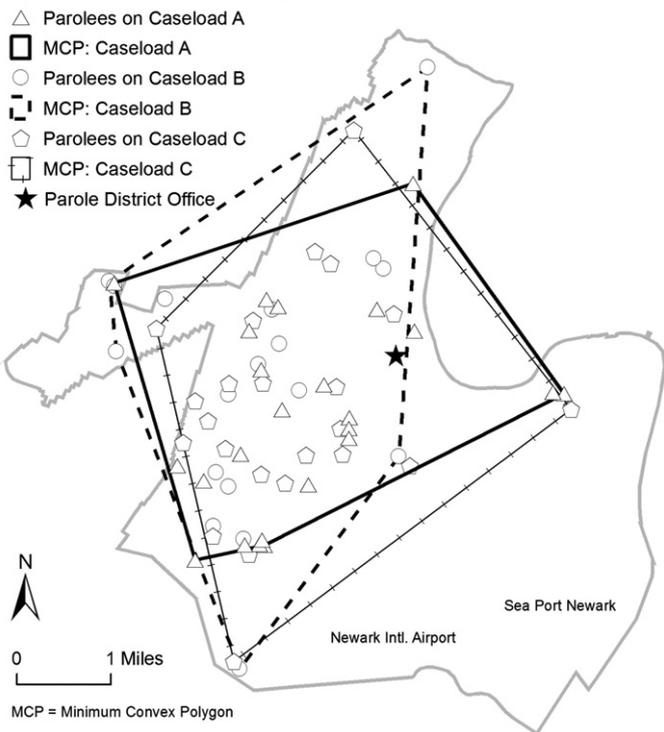
Minimum convex polygons (MCP) were used to show the smallest perimeter within which a parole officer's case load is distributed. Map 4 shows a MCP for all parolees in the study sample. This polygon has a perimeter of 18.96 miles and comprises an area of 24.29 square miles. This is comparable to the boundary of Newark, which has a perimeter of 32.15 miles and comprises an area of 24.49 square miles. Map 5 shows

Minimum Coverage Perimeter of the Newark, NJ Parole District Office



Map 4.

Overlapping Caseloads and Coverage Perimeters for Parole Officers in Newark, NJ



Map 5.

overlapping case loads and coverage perimeters for parole officers A, B, and C. Based upon a GIS analysis of these maps: Parole officer (PO) A's case load of twenty-four parolees represents just 4 percent of the total study sample, but is distributed to a perimeter of 13.49 miles and covers an area of 11 square miles, or 45 percent of the total Newark study area; PO B's case load of twenty-four parolees represents just 4 percent of the total study sample, but is distributed to a perimeter of 14.85 miles and covers an area of 13 square miles, or 53 percent of the total Newark study area; PO C's case load of eighteen parolees represents just 3 percent of the total study sample, but is distributed to a perimeter of 15.41 miles and covers an area of 13 square miles, or 49 percent of the total Newark study area. Note in Table 4, a similar phenomenon for case loads D, E, and F.

Nearest Neighbor analyses validate the conclusion that regardless of case load size, parolees within a given case load are randomly dispersed throughout Newark without any regard to geographic clustering. Based upon a z score of -23.76, the point distribution of all parolees in Newark (n=544) are significantly clustered at p<0.05. This makes intuitive sense because all of the parolees used in this study were located (i.e., clustered) within the geo-political boundary of Newark. It was assumed, however, that the geographic distribution of parole officer case loads would be a logistical concern for the Newark parole district office because the

Table 4
Distribution of parole officers' case loads

Parole officer case load	# of parolees (% of study sample)	Perimeter (miles)	Area (miles ²)	Percent of parole district office's jurisdictional area
All parolees	544 (100%)	18.96	24.29	99
A	24 (4%)	13.49	11.27	45
B	24 (4%)	14.85	13.00	53
C	18 (3%)	15.41	12.04	49
D	8 (2%)	9.38	4.93	20
E	9 (2%)	10.84	6.25	24
F	11 (2%)	10.99	4.98	20

Table 5
Separate nearest neighbor (NN) analyses of parole officers' case loads

Parole officer case load	n	R	Mean NN distance	Expected mean NN distance	S. D.	Z
All parolees	544	.47	336.72	720.30	346.91	-23.76*
A	24	.85	1997.62	2362.52	2005.20	-1.45*
B	24	.99	2670.06	2696.92	2291.74	-0.09*
C	18	.96	2789.72	2906.96	2837.29	-0.33*
D	8	1.44	4016.29	2786.89	1665.19	2.39*
E	9	1.50	4644.80	3099.61	2932.31	2.86*
F	11	1.09	3266.91	2988.22	2014.56	0.59*

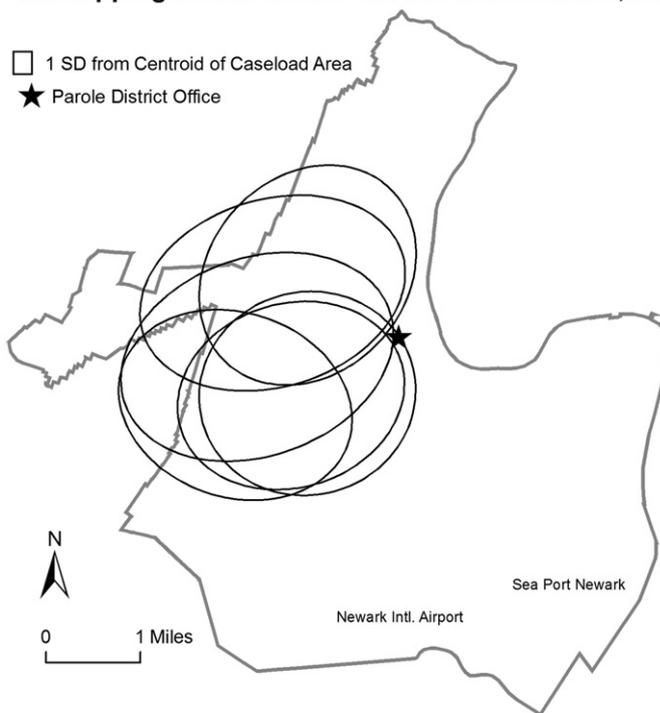
* p<0.05.

geographic distribution of parolees within a case load is an important enabling factor for parole officers to serve as efficient and effective case managers and boundary spanners. Therefore, it was hypothesized that the residential locations of parolees within the same case load would be spatially clustered together in certain parts of Newark. This was not the case.

Separate Nearest Neighbor analyses were performed on the randomly selected case loads. Table 5 presents the statistical output of the NN analysis. Negative z scores indicate a clustered distribution, positive z scores indicate a uniform distribution, and z scores near zero indicate a random distribution. The R values calculated by the NN analysis suggest that the point distributions of parolees on individual case loads are statistically not clustered. Case loads D and E are significantly uniformly distributed, given their large positive z scores; and for case loads A, B, C, and F, one may accept the null hypothesis that the points are randomly distributed throughout Newark at p<0.05. A random distribution suggests no forethought on the part of the parole agency to assign case loads based on the geographic location of parolee residences.

The average distance between all parolee residences in the study sample (n=544) was approximately 337 feet apart; the mean distance

Standard Deviation Ellipses: Overlapping Parole Officer Caseloads in Newark, NJ



Map 6.

among parolees within a similar case load was 3,231 feet. On average, parolees on the same case load reside ten times farther apart from each other than the “natural” geographic distribution of parolee residences within Newark.

Standard deviation ellipses provide further support for the conclusions reached by the NN analyses above. Map 6 shows ellipses representing one standard deviation from the arithmetic mean center of parolees in case loads A, B, C, D, E, and F. Statistically, a majority (68 percent) of residences for each of the parolees on these case loads are located within each (respective) ellipse. Upon visual analysis, one can clearly see that these six randomly selected case loads overlap. What Map 6 statistically represents is that six parole officers are supervising a majority of parolees (sixty-one out of ninety-four) from their combined case loads in an area of less than nine square miles. If the average case load size for parole officers in the Newark District Office is around fifty, then only two parole officers should be required to supervise sixty-one parolees in this nine square mile area.

Three hundred twenty-six (60 percent) of all parolee residences in the study sample were located within the six standard deviation ellipses displayed in Map 6. Since only sixty-one parolees from the randomly selected case loads were located in these areas, it is reasonable to assume that additional parole officers' case loads will overlap with the six that were analyzed here. Therefore, standard deviation ellipses indicate that parole officer case loads are not predicated on any geographic clustering and that there is sufficient spatial overlap among them. Based on the current spatial distribution of parolees and parole officer case loads, current supervision practices of the Newark District Office are less efficient than they could otherwise be.

Discussion and conclusion

GIS is an important tool for understanding the complex nexus of service availability, accessibility, and parolee case management. The various GIS analysis methods used in this study can help parole departments assess the logistical aspects of service delivery and utilization. A relatively large number of social services exist in Newark, with 70 percent of the social services located within one standard deviation from the parolee study sample's center. Disparities in the distribution of services were observed at the type of social service level, however, with types of services not uniformly distributed throughout Newark, thereby potentially impacting the maximum benefits that parolees can derive from these services.

HIV services, for example, are primarily clustered within a two square mile area of the city. Though there is no medical registry information for parolees in this sample, it is unlikely that all parolees in this sample who might be HIV-positive live in this same area, or have easy access to this area. An argument can be made that parolees will migrate to services they need, particularly in a city such as Newark with extensive and easily accessible public transportation options. It is also possible that zoning restrictions prohibit services from being located in residential areas.

The service utilization discussion typically ends here with the identification and the level of spatial mismatch of services and ex-offenders in a given jurisdiction. This analysis moves the research further by acknowledging that even when services exist, boundary spanners must be in place to connect individuals to the services, in this case parole officers coordinating services for parolees. The spider diagram (Map 2) pinpoints the parole district office within one standard deviation of the mean center of parolees and social services and is recommended for future use by parole departments to determine the location of future district offices to maximize the spatial match between parolees, social services, and the parole office where the majority of case management is conducted. Ideally, the closer parole officers are to the services they refer parolees to, the more knowledgeable they will be of these services.

In Washington, D.C., the Court Services and Offender Supervision Agency (CSOSA) recognized that their probation and parole officers

assigned to a central office were having a difficult time learning the community services available for ex-offenders under their jurisdiction. In an effort to address this limitation, probation and parole have expanded their field offices into neighborhoods of high inmate return and used these community field offices as the location where offenders go to meet with their supervising officers. The location of these neighborhood offices allow the community supervisory officers to maximize their travel time when conducting home visits while freeing up time to attend community meetings and interact with other government agencies, such as the police, regarding high-risk offenders. CSOSA is now experimenting with developing one-stop centers in the field offices, so parolees can receive employment counseling and have their other needs met in one location, in close proximity to where they live.

In Newark, the parole department could mirror CSOSA commitment to community-based casework by reevaluating the functionality of the present system which allocates cases to parole officers in a random, unsystematic manner. As Map 5 indicates, parole officer case loads have a high degree of overlap and officers must cover anywhere between 20 to 53 percent of the parole district office region's area to manage their parolees. A revised system of case load allocation based on natural distribution of parolee residences could enhance an officer's knowledge of the community and save time and resources when monitoring the population.

In sum, this study provided empirical evidence that GIS is an instrumental tool for developing a more efficient and effective environment for working with the offender population. This study demonstrated that more attention should be placed on understanding activity space of parolees and to what degree their predisposing and need factors help or hinder their use of services near or far away from their residences. In particular, future research might consider whether service utilization is maximized when parolees have access to programs in their psychological comfort zones or within close proximity to their living space.

Acknowledgement

This work was supported (in part) by a City University of New York PSC-CUNY Research Grant #60007-36 37.

Note

1. Transportation and disability services were excluded from this analysis because there is only one of each of these facilities.

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