

Running head: Geographic Barriers to Treatment on Demand

# **Geographic Barriers to Treatment on Demand in Baltimore City**

Mieka Smart<sup>1</sup>; Damiya Whitaker<sup>1</sup>; Ian Craig<sup>1</sup>; Pierre Alexandre<sup>1</sup>

and Debra Furr-Holden<sup>1</sup>

May 13, 2008

<sup>1</sup> Department of Mental Health, Johns Hopkins University Bloomberg School of Public Health,  
Baltimore, MD

Correspondence should be directed to Mieka Smart, Johns Hopkins University Bloomberg School of  
Public Health, Department of Mental Health, DIVE Studies Laboratory, 111 Market Place, Suite  
850, Baltimore, MD 21202 U.S.A. Tel: (410) 347-3212; Fax (410) 347-3222; E-mail:  
[msmart@jhsph.edu](mailto:msmart@jhsph.edu).

Acknowledgement: Thanks to the Baltimore City Mayor's Office of Information and Technology

Keywords: treatment; access; epidemiology; alcohol and other drug use

**Abstract**

The aims of this study were to (1) estimate the distance between treatment centers and alcohol and other drug- (AOD-) dense neighborhoods in Baltimore City and (2) identify relationships between drug treatment center characteristics and their proximity to drug users. Proximity to service providers and geographic accessibility are documented barriers to addiction treatment-seeking and to program retention in drug users in Baltimore City. Methods included independent observations of selected city blocks during daylight and nighttime hours using the NifETy Method. The resultant data were used to obtain a score of 0-13 on recent or current AOD use. Each city block with a score of 3 or greater was plotted against geographical data for all existing treatment centers in Baltimore City in ArcGIS. Three treatment center characteristics (funding source, treatment services offered, and target service population) were analyzed for potential relationships with proximity to drug users. Funding source and treatment services offered had significant relationships with proximity to drug users. Distances (in miles) to the closest treatment center were significantly greater when treatment centers were privately funded, as compared to publicly funded treatment centers. The closest treatment center to an AOD dense block is more likely to provide outpatient services than inpatient or varied services. These findings have implications for placement of future treatment centers.

## Introduction

The Maryland Department of Health and Mental Hygiene (DHMH) Alcohol and Drug Abuse Administration (ADAA), over 5.7 million dollars are allocated to addiction prevention and treatment in Maryland, most of which go to Baltimore City for the treatment of opiate addiction.<sup>1</sup> Given that alcohol and illicit drug abuse are among Baltimore's most serious problems, initiatives to counter the adverse health and social consequences of addiction are vital.<sup>2</sup> Baltimore Substance Abuse Systems, Inc. (bSAS) uses grant funds to develop and implement treatment programming. To affirm its commitment to that aim, in a recent report bSAS outlined the need for movement towards drug "treatment on demand", a drug policy with the distal goal of ending drug addiction in the United States by providing all of those seeking substance abuse treatment immediate entry into an appropriate program.<sup>3,4,5,6,7</sup> In Baltimore City, "treatment on demand" is defined as "providing treatment within 48 hours of request".<sup>8,9,10</sup>

Traditional measures of the success of the treatment on demand model focus on the operations of treatment facilities including queues, waiting times, service levels (i.e. the fractions of those requesting treatment who actually receive treatment), and capacity.<sup>8,9,11</sup> This model does not take into account that users must be positioned to actually make the demand for treatment. Proximity to service providers is a documented barrier to treatment-seeking in general, to addiction treatment, and to treatment-seeking and retention in drug users in Baltimore City.<sup>12, 13, 14, 15, 16</sup> In Baltimore City, a documented barrier to treatment-seeking and retention in drug users is geographic accessibility.<sup>16, 17</sup> It has also been documented that retention in treatment improves with adequate transportation, indicating that proximity may be of concern.<sup>18,</sup>

The aims of this study are to (1) estimate the distance between AOD users in Baltimore City and treatment, and (2) identify relationships between drug treatment center characteristics and their proximity to drug users. The fundamental questions answered with this research are: (1) where are treatment centers located in relation to AOD dense areas? (2) What treatment center characteristics are related to the distance an AOD user has to travel to get to treatment? (3) Which treatment center characteristics, if any, are related to the presence of a nearby AOD-dense block? It is hypothesized that the related treatment center characteristics include treatment funding type (public vs. private), treatment service types provided (inpatient, outpatient, or varied), and service population (open to a specified population only vs. open to ages and genders).

This paper introduces a refinement to an accepted model of treatment on demand developed by Kaplan and Johri who also agreed that Baltimore is one of the cities that could benefit from treatment on demand.<sup>9</sup> As indicated in Figure 1, the revised model of Drug Treatment Flows would maintain the operational focus necessary for success of treatment on demand, but introduces accessing treatment and inability to access treatment as steps that potentially mediate the relationship between drug use and treatment queue. That step presents the possibility that there are missed treatment opportunities due to barriers (geographic and otherwise) to treatment.

The revised model falls within the larger well-developed gravity model, a probabilistic model that offers insight into the correlates affecting treatment access. The gravity model theorizes that the attraction between two objects is proportional to their mass and inversely proportional to their respective distance. The gravity model has traditionally been used in hospital utilization studies and although geographical accessibility to addiction treatment is not widely studied, general geographic accessibility has been explored with regard to medical health

services under this model.<sup>21,22,23,24,25</sup> For example, Jordan et al found that although travel time is the best measure of access, straight-line distances were highly correlated with actual travel time in urban settings, and therefore that linear distance was an accurate measure of access.<sup>25</sup> Social class has also emerged as a correlate, sometimes with even more strength than distance, implying that close proximity may be especially important for those with walking as their only means of reliable transportation.<sup>21,22</sup>

## Methods

### *Sample of Baltimore City blocks*

Environmental assessments of prevalent AOD use were conducted in the 242 residential neighborhoods of Baltimore City using the Neighborhood Inventory for Environmental Typology (NifETy).<sup>20</sup> Neighborhoods were stratified using geocoded data provided by Baltimore City Mayor's Office of Information and Technology. Although Baltimore City actually contains 272 ecologically defined neighborhoods, 30 are without residences.<sup>20</sup> Because the NifETy was designed to measure neighborhood order and disorder in urban residential areas, any blocks located in Baltimore City's 30 non-residential neighborhoods were excluded from the sample population.<sup>20</sup>

### *Data collection*

Paired raters independently assessed selected city blocks during daylight and nighttime hours using the NifETy. Their observational assessments included 13 physical or social indicators of recent and/or current AOD use: People Using Drugs, Syringes, Drug Baggies, Drug Vials or Vial Caps, Blunt Guts or Wrappers, Pot Roaches or Roach Clips, Crack Pipes, Other Drug Paraphernalia (including heroin spoons, joint rolling paper/packs, etc.), People Using

Alcohol, Whole Alcohol Bottles, Broken Bottles, Obvious Signs of Drug Selling, and Intoxicated People (drug or alcohol intoxication).

#### *Creation of AOD-density Subscale*

The NIfETy assessments were aggregated and made binary, giving each block a potential score of 0-13 for the 13 indicators of recent or current AOD use. A score of 0 indicates that neither rater found any AOD indicators on that block. A score of 13 means that all 13 AOD indicators listed above were observed by either one rater or the other. One hundred seventy-two blocks with scores of 3 or more were labeled as AOD-dense, and served as the final sample for this analysis.

#### *Analysis*

The final sample blocks were exported into ArcGIS 9.2 for geocoding. Geocoding is the process of assigning geographic identifiers (codes or longitude/latitude coordinates) to data records, such as street addresses. In this case, the identifiers are Summary Tape File IDs (STFIDs), the geographic identifiers developed by the U.S. Census that combine the county code, census tract code and block code. The BSAS database provides location data for all active treatment centers as of 2006 that serve the Baltimore City population. All Treatment centers that lie outside Baltimore City were excluded from this analysis. Location data for BSAS tracked centers were exported into ArcGIS 9.2 and geocoded.

In ArcGIS 9.2, radii that encircled the closest treatment centers were recorded for all blocks in the final sample. The radius categories are .10 mile, .25 mile, .50 miles, .75, 1.00 mile, 2.00 miles and 5.00 miles. 43 of the treatment centers in Baltimore City serve as the nearest treatment center (i.e. those 43 centers serve as the most likely treatment portal, for at least one

AOD-dense location. I. When the closest treatment center for each block was determined with the radius function, the distance to that treatment center was calculated in linear miles.

Three treatment center characteristics (funding type, treatment type, and service population) were analyzed for potential relationships with proximity to drug users. These data were exported in to SPSS and Mann-Whitney, Kruskal-Wallis, ANOVA and t-tests were employed. The t test assesses whether the means of two groups are statistically different from each other and was utilized to compare the mean distance in miles from AOD-dense blocks to treatment centers for publicly versus privately funded treatment centers and for specialty versus open-to-all treatment centers. The Mann Whitney test is a nonparametric test for assessing whether two samples are drawn from a single population distribution and was utilized to compare radii encircling closest treatment center and AOD density scores for publicly versus privately funded treatment centers and specialty versus open-to-all treatment centers. Kruskal Wallis, also a nonparametric method, is used to test the quality of population medians among groups. It is an extension of the Mann Whitney test and is used in this analysis to distinguish differences in the distributions of radii categories and AOD density scores for treatment centers offering inpatient versus outpatient versus varied services. ANOVA (Analysis of variance) is designed to compare variability of the observations among groups to that within groups – it examines hypotheses about the differences among the means of groups of observations relative to the variance of the individual groups. In this case, the one-way ANOVA was used to compare differences among the mean distances in miles among inpatient, outpatient and varied treatment locations to the variances of the distance in miles within the inpatient, outpatient, and varied treatment centers.

## Results

AOD-dense blocks had a distinct geographic distribution of two large clusters of AOD-dense areas in central East and central West Baltimore, with spindling AOD-dense areas towards the perimeter of the city (Figure 2). The geographic distribution of treatment centers closest to AOD dense areas does not mirror that of the AOD dense areas in Baltimore City. There is one large cluster of treatment centers in the center of the city, with sparse locations towards the city perimeter (Figure 3). Radii from AOD-dense blocks encircling the closest treatment center ranged from narrow (50 ft.) to wide (5 miles). The calculated radii were split into four categories. Table 1 presents radii category and AOD density score frequencies.

The treatment center characteristics are presented in Table 2. Treatment centers that are publicly funded receive operation dollars solely from BSAS. Treatment centers that are wholly or partially funded with private dollars benefit from spending by private insurers, charities, patients and their families. Treatment centers that cater to only a segment of the treatment seeking population are designated as having a “specialty” treatment population in this study. Specialty treatment centers include those for men only, youth only, women and children only, etc. Treatment centers that do not specialize are designated “open to all.” Figure 4 displays the 172 AOD-dense blocks plotted against their closest treatment centers. Table 3 displays the results of the Analysis Matrix presented in the Methods section of this paper.

## **Discussion**

The linear distance to the closest treatment center in Baltimore City is less than one mile for most AOD-dense blocks. From AOD-dense blocks detected by the NIFETy AOD-density subscale, the median radius from block center to encircle a treatment center is .5 miles. One could conclude that AOD-dense blocks are closely located to treatment centers, but it should be reiterated that the measurements in this analysis are presented in linear miles. More powerful

analysis could be conducted by summing the length of moves in N-S and E-W directions (the Manhattan or city-block metric). Although calculations using Manhattan miles would result in distances longer than those presented in this research, those calculations would be more in line with actual distances traveled by a resident from an AOD-dense block to his closest treatment center.

Distances (in miles) to the closest treatment center were significantly greater when treatment centers were privately funded, as compared to publicly funded treatment centers. This means that the privately funded treatment centers are not centrally located (i.e. not close in proximity to other treatment centers) and tend to be the centers located towards the periphery of the City. Figure 5 indicates that this is the case. Neither population served nor treatment type characteristics were associated with distances to treatment centers.

The closest treatment center to an AOD dense block is more likely to provide outpatient services than inpatient or varied services. This finding is not surprising, as the nature of outpatient services require heavy AOD-user foot-traffic. The finding has implications for placement of future treatment centers. Based on this data, Baltimore City residents with the “not in my backyard” attitude towards treatment centers have good reason to be concerned. The NifETy data could provide a strong assessment of how treatment centers are doing with the work of improving, as opposed to marring, the faces of the communities to which they locate.

### **Clinical and Public Health Significance**

Proximity data provide important information on the areas in Baltimore that may have unmet needs that prevent the Treatment on Request goal from being realized. To our knowledge, this is the first study of its kind in the United States that focuses on treatment centers’ geographic locations and how those locations impact users’ access. This data is useful for planning future

treatment center locations. For instance, there are visible holes in treatment center locations on the east and west sides of Baltimore City, when compared with AOD-dense locations. Although only a few research questions were presented here, the data set is rich with possibility for improving the likelihood of treatment on demand in Baltimore City.

### References

1. Maryland Alcohol and Drug Abuse Administration Operating Budget Data 2008. Available at: [http://maryland-adaa.org/ka/ka-2.cfm?folder\\_id=319&parent=163&levels=2&type=1](http://maryland-adaa.org/ka/ka-2.cfm?folder_id=319&parent=163&levels=2&type=1) Accessed April 17, 2008.
2. Reuter, Peter; Hsu, Margaret; Petronis, Ken, and Wish, Eric. Estimating the Need for Substance Abuse Treatment in Maryland. College Park, MD: Maryland Alcohol and Drug Abuse Administration; 1998
3. Johnson, J.L., Ahmed, A., Plemons, B., Powell, W., Carrington, H., Graham, J., Hill, R., Schwartz, R.P., Brooner, R.K., 2002. The Baltimore Drug and Alcohol Treatment Outcomes Study. Baltimore Substance Abuse Systems Report.
4. D.R. Gerstein and H.J. Harwood, eds., Treating Drug Problems (National Academy Press, Washington, DC, 1990).
5. Substance Abuse and Mental Health Services Administration, National Treatment Improvement Evaluation Study (Department of Health and Human Services, Center for Abuse Treatment, Washington, DC, 1996).
6. C.P. Rydell, J.P. Caulkins and S.S. Everingham, Enforcement or treatment? Modeling the relative efficacy of alternatives for controlling cocaine. *Operations Research*. 1996; 44: 687–695.
7. Gerstein, Dean R.; Johnson, Robert A.; Foote, Mary L., et al. Evaluating Recovery Services: The California Drug and Alcohol Treatment Assessment (CALDATA) Methodological Report. Chicago, IL: National Opinion Research Center, 1994.
8. Friedmann, P.D., Lemon, S.C., Stein, M.D., and D'Aunno, T.A.. Accessibility of Addiction Treatment: Results from a National Survey of Outpatient Substance Abuse Treatment Organizations. *Health Services Research*. 2003; 38:3, 887-903.
9. Kaplan, E.H., and Johri, M. Treatment on demand: an operational model. *Health Care Management Science*. 2000;3:171-183.
10. S. Shane, Cost of addiction carries “hidden tax”: city doubles spending on treatment to cut price paid by public. *Baltimore Sun* (April 30, 1998) 1A.
11. Pollini, R.A., McCall, L., Mehta, S.H., Vlahov, D., and Strathdee, S.A. Non-fatal overdose and subsequent drug treatment among injection drug users. *Drug Alcohol Depend*. 2006;83:104-110
12. Strauss, B.A., MacLean, C., Troy, A., Littenberg, B. Driving Distance as a Barrier to Glycemic Control in Diabetes. *Journal of General Internal Medicine*. 2006;21, 378-380.
13. Bauld, L., Coleman, T., Adams, C., Pound, E., Ferguson, J. Delivering the English smoking treatment services. *Addiction*. 2005;100, 19-27.
14. Appel, P.W., Ellison, A.A., Jankys, H.K., and Olkac, R. Barriers to enrollment in drug abuse treatment and suggestions for reducing them: opinions of drug injecting street

- outreach clients and other system stakeholders. *American Journal of Drug and Alcohol Abuse*. 2004;30:129-153.
15. Kopelman, T., Huber, D.L., Kopelman, R., Sarrazin, M.V., Hall, J.A. Client satisfaction with rural substance abuse case management services. *Care Management Journals*. 2006; 7:179-190.
  16. Latkin, C.A., Davey, M.A., Hua, W. Needle Exchange Program Utilization and Entry into Drug User Treatment: Is There a Long-Term Connection in Baltimore, Maryland? *Substance Use & Misuse*. 2006;41:1991-2001.
  17. Simpson, D. D., Joe, G. W., Rowan-Szal, G. A., & Greener, J. M. Drug abuse treatment process components that improve retention. *Journal of Substance Abuse Treatment*. 1997;14: 565– 572.
  18. Ducharme, L.J., Knudsen, H.K., Roman, P.M. Evidence-Based Treatment for Opiate-Dependent Clients: Availability, Variation, and Organizational Correlates. *The American Journal of Drug and Alcohol Abuse*. 2006; 32: 569-576.
  19. Pringle, J.L., Emtage, N.P., Hubbard, R.L. Unmet needs for comprehensive services in outpatient addiction treatment. *Journal of Substance Abuse Treatment*. 2006;30: 139-189.
  20. Furr-Holden, C. D. M., Smart, M.J., Pokorni, JP; Ialongo, NS; Holder H; Anthony JC. (Under Review). The NifETy Method for Environmental Assessment of Neighborhood-level Indicators of Violence, Alcohol, Tobacco, and Other Drug Exposure. *Prevention Science*.
  21. Weiss JE, Greenlick MR. Determinants of Medical Care Utilization: The Effect of Social Class and Distance on Contacts with the Medical Care System. *Medical Care*. 1970; 8: 456-462
  22. Morrill RL, Erickson RJ, Rees P. Factors Influencing Distances Traveled to Hospitals. *Economic Geography*. 1970; 46: 161-171
  23. Cohen MA, Lee HL. The Determinants of Spatial Distribution of Hospital Utilization in a Region. *Medical Care*. 1985; 23: 27-28
  24. Morrill RL, Schultz R. The Transportation Problem and Patient Travel To Physicians and Hospitals. *The Annals of Regional Science*. 1971; 5: 11-24
  25. Jordan H, Roderick P, Martin D, Barnett S. Distance, rurality and the need for care: access to health services in South West England. *International Journal of Health Geographics*. 2004; 3: 21

Figure 1: Revised Model of Drug Treatment Flows

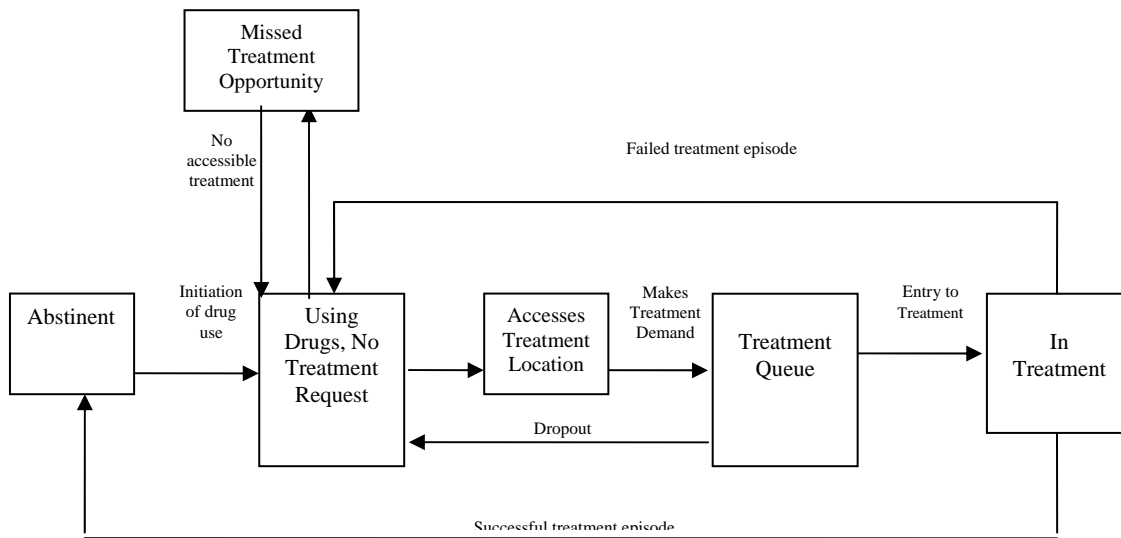


Figure 2: AOD-dense block locations in Baltimore City

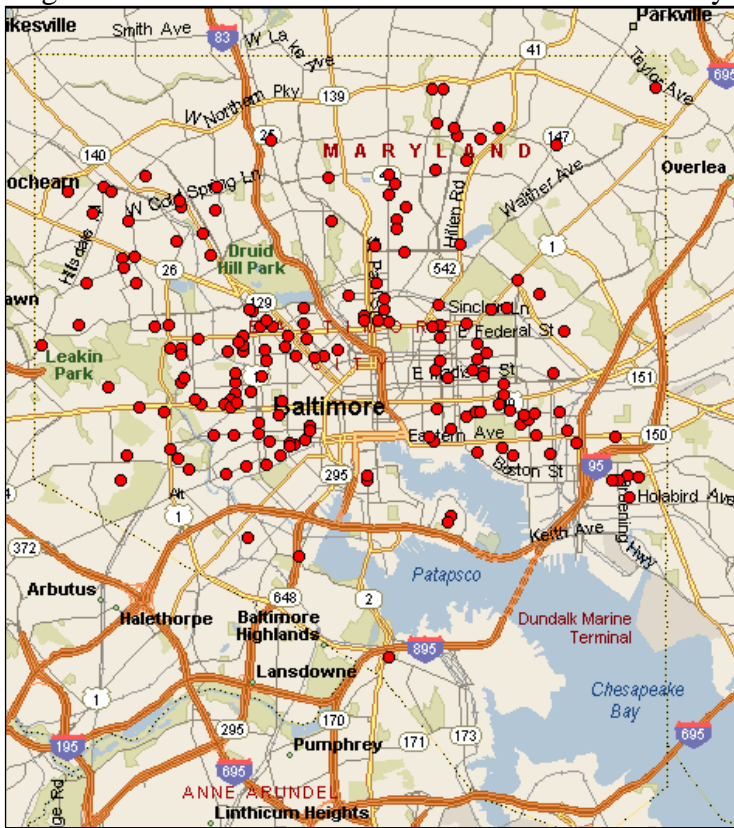


Figure 3: Treatment centers closest to AOD dense block locations in Baltimore City

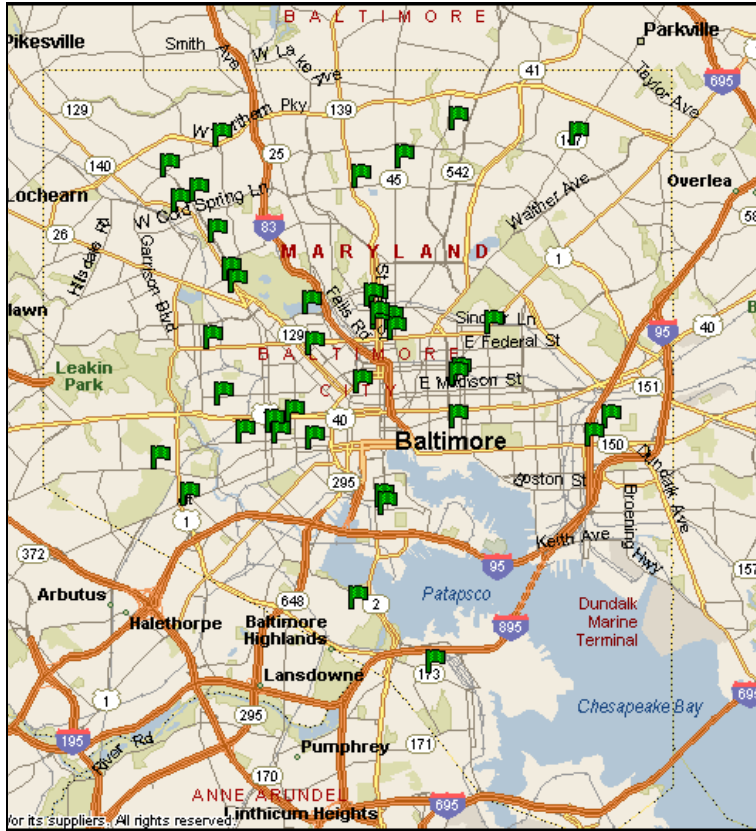


Figure 4: AOD-dense blocks plotted against treatment centers

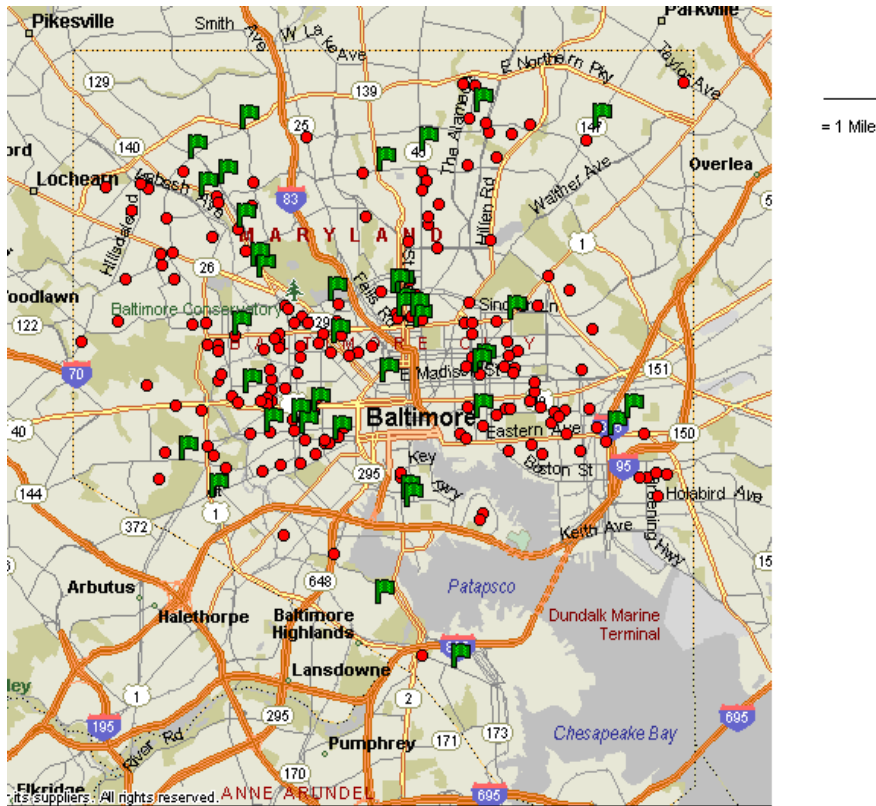


Figure 5: Privately Funded Treatment Centers

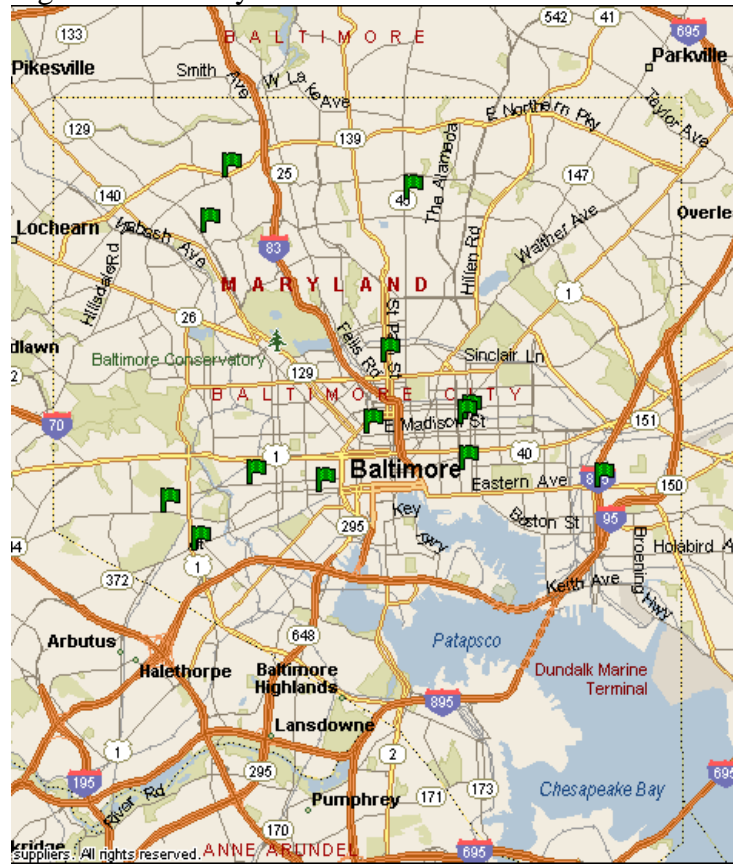


Table I: Characteristics of AOD-dense blocks (n=172)

	No	%
<b>Radii encircling closest treatment centers</b>		
<b>Radius Category</b>		
.25 mile or less	41	23.8
.26 to .5 mile	47	27.3
.51 to .75 mile	39	22.7
.76 mile or more	45	26.2
Total	172	100.0
<b>AOD Density Scores for AOD-dense blocks</b>		
<b>AOD Density Score</b>		
3	71	41.3
4	62	36.0
5	25	14.5
6	8	4.7
7	5	2.9
8	1	.6
Total	172	100.0

Table II: Characteristics of treatment centers closest to AOD-dense blocks (n=43)

	No	%
<hr/>		
Funding Type		
Public Only	30	69.8
Private/Both	13	30.2
Total	43	100.0
<hr/>		
Treatment Population		
Specialty	15	34.9
Open to All	28	65.1
Total	43	100
<hr/>		
Treatment Type		
Inpatient	12	27.9
Outpatient	24	55.8
Both In and Outpatient	7	16.3
Total	43	100.0
<hr/>		

Table 3: Results tabulated by test. Significant findings are in bold.

		Access Indicator 1 <i>Radius Category</i>	Access Indicator 3 <i>Distance in Miles to nearest treatment</i>	Access Indicator 2 <i>Block NifETy AOD Density Score</i>
Treatment Variables	Funding Type: <i>Public</i> V. <i>Private</i>	Mann-Whitney Wilcoxon W=4238 p=0.54	<b>Unpaired <i>t</i> test</b> <b><i>t</i>=5.406</b> <b><i>p</i>=.062</b>	Mann-Whitney Wilcoxon W=2832 p=.365
	Treatment Type: <i>Inpatient</i> <i>Outpatient</i> <i>Varied</i>	Kruskal-Wallis H=1.9 p=.368	One-Way ANOVA F=.973	<b>Kruskal-Wallis*</b> <b>H=6.43</b> <b>p=.042</b>
	Population Served: <i>Specialty</i> V. <i>Unspecified</i>	Mann-Whitney Wilcoxon W=3012 p=.217	Unpaired <i>t</i> test <i>t</i> =.948 p=.345	Mann-Whitney Wilcoxon W=5117 p=.586

\*Further Mann-Whitney tests were employed to determine which group's differences were significant.