Travel distance to outpatient substance use disorder treatment facilities for Spanish-speaking clients

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Abstract

Background—Travel distance and English proficiency skills are widely recognized factors associated with service access and treatment engagement. As Latino populations represent one of the most rapidly growing populations in the United States, methods are needed to better understand availability of linguistically appropriate services in Latino communities. Given regional variability in the density of Latino communities, the current study examines treatment access as travel distance to outpatient substance use disorder treatment facilities in one of the largest and most rapidly changing Latino communities in the United States – Los Angeles County, CA.

Methods—Data from the 2010 U.S. Census and the National Survey of Substance Abuse Treatment Services were analyzed using a geographic information system approach to determine the street-level distance between treatment facilities with services in Spanish and Latino communities throughout L.A. County. This study used an innovative approach that included network analysis and spatial autocorrelation to identify "hot spots," i.e. clusters of census tracts with high-density Latino populations that were relatively far from treatment services in Spanish.

Results—The analysis identified several key hot spots with significantly large Latino populations and far street distances to the closest facility offering Spanish-language services. The average distance between these hot spots and the closest facilities was 2.74 miles (SD = 0.38), compared to a county average of 2.28 miles (SD = 2.60). In several key hot spots, the distance was greater than 3 miles.

Conclusion—Despite the growing presence of Latinos in L.A. County in 2010, constrained access to services in Spanish was found in geographic locations highly represented by Latinos.

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Author contributions

Dr. Erick Guerrero designed the study, managed the literature searches and summaries of previous related work, contributed to the design and interpretation of the GIS analysis, and worked with Dr. Dennis Kao and Dr. Brian Perron to draft the manuscript. Dr. Kao conducted the GIS analysis and drafted the results section. All three authors contributed to and approved the final manuscript.

Conflict of interests

The authors declare that they have no competing interest of any kind.

The distances identified in this study are almost triple the 1-mile threshold representing reduced access to treatment as determined by other studies. Geographic information systems represent an innovative and user-friendly approach for effectively and efficiently identifying areas with the greatest service needs. This approach can inform policies to increase the capacity of ethnic minority communities to develop linguistically responsive social services.

Keywords

Spanish-language services; Substance use disorder treatment; Geographic information system; Latinos

Introduction

Improving the accessibility of outpatient substance use disorder (SUD) treatment enhances opportunities for individuals to address substance-related problems. Significant evidence suggests that race, ethnicity, income, and language are barriers to accessing treatment services (Galea, Nandi, & Vlahov, 2004; Ulmer, McFadden, & Nerenz, 2009). In the United States, Latinos are more likely to live in low-income communities with greater access to alcohol and illegal substances (De La Rosa, Holleran, Rugh, & MacMaster, 2005; Williams & Collins, 2001) and often have limited access to behavioural health services in Spanish (González, Vega, & Tarraf, 2010). Accessibility to services in Spanish in this study refers to the travel distance between Latino communities and facilities offering SUD treatment services in Spanish. A considerable number of treatment facilities offer services in Spanish (66%) in the most populous and ethnically diverse county in the United States (Los Angeles County, CA) (SAMHSA, 2010). Yet, it is not certain whether these facilities are strategically located where they are most needed.

The primary aim of this exploratory study was to identify the street-level distance between low-income Latino populations with mostly limited English proficiency and outpatient SUD treatment services offered in Spanish in L.A. County. A secondary aim was to demonstrate the utility of geographic information systems (GIS) with respect to measuring and describing travel distance as a measure of service accessibility. Although the analysis of travel distance is exploratory, this study expands on our preliminary work on the straight or linear geographic distance between two defined points, namely Latino communities in L.A. County and SUD treatment services in Spanish (Guerrero, Pan, Curtis, & Lizano, 2011).

The data and methods used in this study are ideal for generalizability to diverse settings. More specifically, even though the current study relies on census tracts and street-level data that may not be available in other countries, the use of GIS can incorporate other geographic features that may be used to define community boundaries. Moreover, this approach may be particularly valuable in terms of helping developing countries more effectively plan services for highly urban, sprawled communities with large concentrations of ethnic minorities, particularly those with a potential need for linguistically responsive social services.

Overview of the treatment system and Latino population in L.A. County

L.A. County has one of the largest publicly funded SUD treatment systems in the nation, providing services to one of the most ethnically diverse populations nationwide (Crèvecoeur, Finnerty, & Rawson, 2002). Approximately 42% of those in L.A. County who attend treatment self-identify as Latino, of which 75% self-identify as Mexican or Mexican American (Office of Applied Research & Analysis, 2007a; Office of Applied Research & Analysis, 2007b). Latinos served by publicly funded treatment facilities in California have the highest use of methamphetamine and alcohol compared to other racial/ethnic groups (Fosados, Evans, & Hser, 2007). Moreover, Latinos of Mexican descent generally report the highest rates of alcohol binging in national samples (Caetano, Ramisetty-Mikler, & Rodriguez, 2008; Schmidt, Ye, Greenfield, & Bond, 2007).

According to the U.S. Census Bureau (2009), approximately 4.7 million Latinos reside in L.A. County, representing the largest concentration of Latinos in the nation. Although this population is mostly bilingual (English/Spanish), the latest census data suggests that up to 83% of Latinos in L.A. County speak Spanish at home and 41% report limited English proficiency (American Community Survey, 2010). U.S. federal and state legislation, through the Patient Protection and Affordable Care Act and California's access-to-services law, mandates that all health care providers offer translation or appropriate language services to those with limited English proficiency (Andrulis, Siddiqui, Purtle, & Duchon, 2010). Preliminary research based on 2000 data highlighted an average linear distance of 4 miles between several geographic locations throughout L.A. County with high concentrations of Latinos and facilities offering SUD treatment services in Spanish (Guerrero et al., 2011). However, given the considerable recent growth of the Latino population and changes in the infrastructure of the treatment system in L.A. County, the geographic distance to treatment services in Spanish for the current population is unknown.

Access to treatment services

The disparity between the need for and access to SUD treatment services among ethnic minorities is significant (Fosados et al., 2007; Marsh, Cao, Guerrero, & Shin, 2009; Schmidt et al., 2007; Wells, Klap, Koike, & Sherbourne, 2001). Latinos are more likely than other ethnic minority groups to experience delays in accessing treatment (Wang et al., 2005; Wells et al., 2001) and receive less adequate services (Guerrero, 2010; Marsh et al., 2009). These two factors are associated with a low level of client satisfaction (Wells et al., 2001) and represent some of the most common barriers to behavioural health services among Latinos (Vega et al., 2007). Further, linguistic preferences significantly impact treatment adherence among Latinos (González et al., 2010; Guerrero & Andrews, 2011; Jani, Ortiz, & Aranda, 2009; Vega et al., 2007). In particular, limited availability of bilingual treatment services is highly associated with high levels of attrition from SUD treatment among Latinos when compared with other racial/ethnic groups (Campos, Yang, Urada, Hunter, & Tiburcio, 2009; Glick & Moore, 1996; SAMHSA, 2002; Shorkey, Windsor, & Spence, 2008).

Distance and access to outpatient treatment services

Few, if any, studies regarding Latinos and access to services have focused on distance as a potential barrier, yet research suggests that it is an important factor when considering access

and completion/attrition rates (Beardsley, Wish, Fitzelle, O'Grady, & Arria, 2003; Fortney, Booth, Blow, Bunn, & Loveland Cook, 1995; Schmitt, Phibbs, & Piette, 2003). Various studies have employed GIS to examine the distribution of treatment centers and the relationship between distance and treatment access. In a study of services in urban areas throughout the United States, Perron, Gillespie, Alexander-Eitzman, and Delva (2010) found that less than 5% of California's urban areas are underserved in terms of having readily accessible substance abuse treatment services. These authors also noted significant regional variability in their study, requiring analysis at the community level in order to strategically locate specific services.

Using 2000 U.S. Census data on Latino communities in L.A. County and 2010 federal data from Substance Abuse and Mental Health Services Administration (SAMHSA) on outpatient treatment facilities offering services in Spanish, Guerrero et al. (2011) identified community pockets with *linear distance* to services that ranged from 2 to 6 miles. The northeast area of the county – known as Service Provision Area 3 – reported the greatest linear distance to treatment facilities offering services in Spanish. However, using data from 2000 and relying on linear distance to determine accessibility limits the applicability of findings for policy development. Furthermore, linear distance is not necessarily a valid measure of travel distance, given that the distance between two points is frequently much shorter than travel by road (McLafferty, 2003).

Increasing evidence suggests that distance, which can impact travel times to outpatient treatment settings, can have a significant effect on service utilization. Fortney et al. (1995) studied 106 clients receiving treatment for depression and found that increased travel time to providers was significantly associated with fewer visits. Increased travel time was also associated with a greater likelihood of receiving less effective care (Fortney et al., 1995). Similarly, Beardsley et al. (2003) focused on the distance travelled by 1735 clients to various outpatient treatment programmes in an urban setting. They found that distance is strongly correlated with treatment completion and higher retention rates; specifically, clients who travelled less than 1 mile were more likely to complete treatment than those who travelled farther. Because Latinos report high rates of logistical barriers to receipt of services (Vega et al., 2007), they are particularly vulnerable to the effects of distance on service access and treatment completion.

Highlighting potential barriers to health care access such as distance to treatment is valuable, as past studies indicate that treatment completion rates are affected by transportation issues related to distance to outpatient treatment sources (Friedmann, D'Aunno, Jin, & Alexander, 2000). In particular, low-income individuals with significant transportation and communication challenges are at a considerable disadvantage in terms of addressing their drug-related issues. Given the importance of geographic proximity of Spanish-language treatment services for Latinos with limited English proficiency, we expect that outpatient facilities located closer to communities in L.A. County with large Latino populations will be more likely to offer services in Spanish.

Methods

Data and sampling frame

We used two sources of existing and publicly available data to map outpatient service availability in relation to Latino communities. The list of treatment facilities was retrieved from SAMHSA's online facility locator in November 2010. The National Survey of Substance Abuse Treatment Services (N-SSATS) collected information from all facilities, public and private, that provide services in the United States as part of SAMHSA's annual census of drug treatment facilities. Although collected annually, these data are cross-sectional, providing a yearly count of facilities and their structural characteristics that informs the National Directory of Drug and Alcohol Abuse Treatment Programmes. More information about the sampling frame is available from SAMHSA (2010).

For this study, the boundaries used for Latino communities were based on census tracts – geographic units defined by the U.S. Census Bureau (2001) that include approximately 1500–8000 people. The maps were derived from the U.S. Census Bureau's online database shape files (USCB, 2010). Los Angeles County has 2346 census tracts; of these, 12 census tracts were uninhabited, leaving a final sample of 2334 census tracts. These data were then linked to Hispanic/Latino ethnicity data from the 2010 census (USCB, 2011). Fig. 1 shows a thematic map of Los Angeles County depicting the percentage of Latinos in each census tract and the location of Spanish-language treatment facilities.

Selection procedure

To systematically identify the facilities in L.A. County for the present study, three selection criteria were used when searching the SAMHSA database: (1) the facility is primarily a SUD treatment facility (excluding all general or mental health facilities); (2) the facility provides mainly outpatient treatment services, which refers to services rendered at a facility and consisting of individual, group, and/or family sessions, usually for an hour to 90 min once to three times a week; and (3) the facility provides services in Spanish through a bilingual counselor. Based on these criteria, 191 outpatient treatment facilities were included in the final analysis.

Analytical framework

Data from the U.S. Census Bureau and SAMHSA's facility locator were consolidated and initially analyzed using ArcGIS 10, a mapping software system designed to facilitate the collection, management, and analysis of spatially referenced information and associated attribute data (Esri, 2011a). A two-phase spatial analytical approach was subsequently used to locate key Latino communities with greater travel distances to facilities offering services in Spanish.

In the first phase, the distance from each census tract to the closest Spanish-language treatment facility was calculated using a street network-based spatial analysis. This type of analysis requires two map layers: one for facilities and another for census tracts. To create the first map layer, the geographic coordinates of each facility were geocoded based on its address. Next, since distance is derived from two points, the centroid (or geographic center)

of each census tract was calculated to create the second map layer. Using a street network based on Esri's StreetMap data (Esri, 2006), an analysis was conducted to determine the route from the centroid of each census tract to the closest facility. Four tracts were excluded from the final analysis because their geographic centroids either ended up outside the analytical area (e.g. in the Pacific Ocean) or were not able to be located on the street network. The result of this first phase was a map layer with distance values for each census tracts.

The second phase focused on using spatial autocorrelation analysis to identify significant clusters of census tracts with both large concentrations of Latinos and farther distances to treatment facilities. Spatial autocorrelation refers to the interdependence or interrelatedness among geographic units (in this case, census tracts), particularly units that are closer to each other (Longley, Goodchild, Maguire, & Rhind, 2005). Based on Anselin (1995) work on local indicators of spatial association (LISA), also referred to as local Moran's I, this approach statistically compares geographic units (in this case, census tracts) with significantly high or low values of a particular characteristic with neighbouring units that have comparably high or low values. Positive spatial autocorrelation exists when neighbouring units are significantly similar in attributes, e.g. census tracts with high or low values neighbouring other tracts with similarly high or low values (high-high or low-low). Negative spatial autocorrelation occurs when neighbouring units are more dissimilar than units that are further from each other (Anselin, 1995; Longley et al., 2005).

In our analysis, we calculated local Moran's I values to determine the extent of clustering of census tracts based on two measures: (1) the distance in miles from each census tract's geographic centroid to the closest treatment facility; and (2) the census tract's proportion of Latinos per total population. A cluster includes the "core" census tract and its neighbouring census tracts that have similarly high or low values. To calculate the local Moran's I, we used a queen-based contiguity weight matrix, which considers neighbouring census tracts as having either common boundaries or vertices. A positive local Moran's I would indicate clustering or grouping of census tracts with similarly high or low values across their characteristics; these clusters are referred in this study as *hot spots*. A finding of significant clustering or spatial autocorrelation would suggest that the values for the observed variables are too similar across neighbouring census tracts to be random. Specifically, we were interested in identifying the hot spots that had both the largest Latino concentrations and farthest distances to the nearest facility. Significance was based on an alpha level of .05.

Data management, geocoding, and map production were conducted with ArcGIS 10 (Esri, 2011a), and the network analysis (determining the closest facility) was conducted using Esri's Network Analyst extension (Esri, 2011b). The spatial autocorrelation analysis was conducted with OpenGeoDa 0.9.9.10 (Anselin, Syabri, & Kho, 2006; GeoDa, 2011).

Results

As shown in Fig. 1, Latinos were well-represented in many parts of Los Angeles County in 2010, as indicated by the darker-coloured census tracts. Latinos comprised at least half of the population in 46% of the county's 2334 census tracts and three quarters of the population

in 536 census tracts (23%). Latinos were largely concentrated in three general regions: southeast Los Angeles (e.g. downtown Los Angeles, East Los Angeles, Pico Rivera, Lynwood, South Gate), the San Gabriel Valley (e.g. El Monte, South El Monte, Irwindale, Azusa, La Puente, City of Industry), and the San Fernando Valley (San Fernando and its surrounding areas).

Fig. 1 also displays the location of the 191 facilities offering Spanish-language services; a visual inspection of the map reveals several areas with seemingly fewer facilities. However, visual inspection of map-based data is subject to various interpretations and biases. Therefore, the spatial autocorrelation analysis was used as an attempt to empirically assess and identify these key areas, or hot spots.

The spatial autocorrelation analysis, as displayed in Fig. 2, revealed the presence of numerous hot spots (local Moran's $I = -0.33$), including several hot spots with both large Latino populations and farthest distances to the closest facility offering Spanish services (these hot spots are depicted on the map as the darkest-shaded census tracts). For simplification, these five hot spot regions have been designated with the letters A–E. It should also be noted that the results also showed hot spots in the other extreme – i.e. statistically significant clusters of census tracts with small Latino populations and shorter distance to treatment facilities. However, for the purposes of this study, we were primarily interested in hot spots with a large presence of Latinos and farther travel distance to treatment, which may indicate areas with the greatest need for treatment services in Spanish.

As shown in Fig. 2, five hot spots were located in the following regions: northwest Los Angeles and San Fernando (hot spot A); central Los Angeles and East Los Angeles (B); San Gabriel Valley, including the cities of South El Monte, Baldwin Park, and Irwindale (C); Pomona (D); and Santa Fe Springs (E). As shown in Table 1, these hot spots have relatively large concentrations of Latinos compared to the county as a whole. In 2010, Latinos represented 82% of the total population in the hot spots, ranging from 74.2% of the population in hot spot E to 86.4% in hot spot A. Based on an independent samples t-test (not included in tables), the mean distance to the closest facility offering services in Spanish was higher in the five hot spots identified here compared to the mean distance for the rest of the county: 2.74 miles (SD = 0.38) versus 2.27 miles (SD = 2.63), respectively ($t = -6.20$, $p < 0.001$).

Most notably, the analysis clearly identified hot spot C, a large cluster of 24 tracts in the eastern part of the county commonly referred to as the San Gabriel Valley. This area has a large concentration of Latinos, representing 82% of the population. Moreover, the average distance to the closest facility offering services in Spanish was 2.93 miles (SD = 0.41) – more than a quarter-mile farther than any other hot spot and 0.65 miles farther than the county average.

Finally, Fig. 3 and Table 2 provide a closer look at the population distribution of hot spot C. Of the 24 census tracts in this area, Latinos comprised at least 85% of the population in 11 tracts, including two tracts with at least 90% of the population identifying as Latino (census tracts 4046.00 and 4340.04). The distance to the closest treatment facility varied within the

hot spot, ranging from a minimum distance of 2.36 miles to a maximum of 4.19 miles. In eight tracts largely located in Irwindale, Baldwin Park, and Avocado Heights (4026.00, 4049.01, 4050.01, 4070.02, 4083.01, 4083.02, 4083.03, 5003.00), the distance to the closest facility was more than 3 miles. One tract (4083.03) had a distance of more than 4 miles.

Discussion

Based on current census data and an innovative street network GIS analysis, we identified distinct clusters of census tracts with limited availability of outpatient services in Spanish in the county with the largest population of Spanish-speaking Latinos in the United States. Our preliminary research (Guerrero et al., 2011) using census data from 2000 identified severe linear distances to services in Spanish in the northeast area of the county. In 2000, these were considered fragmented but expanding Latino communities that had the greatest need for services in Spanish as indicated by social services reports (United Way of Greater Los Angeles, 2007).

Using the most current population and facilities data from 2010 in the current study allowed us to identify specific areas of need for services in Spanish within the originally identified region, which we designated as hot spot C. Although all hot spots identified in the study reflect different regions of the county, they are all highly populated by Latino residents who for the most part (80%) speak primarily Spanish in the home (USCB, 2000b).

This study revealed different hot spot locations than those identified in our previous study, which used census data from 2000. The Latino population in L.A. County grew approximately 11% from 2000 to 2010, adding nearly half a million people (USCB, 2000a; USCB, 2011). Measuring geographic distance using street network data rather than a linear approach identified different clusters of census tracts in need, as well as different mean distances (i.e. 3–6 miles using linear distance versus 2 to 4 miles using a street network). We feel confident that compared to simple linear distance measures, street-level distance as highlighted in this paper is a more reliable measure of travel distance. In Los Angeles County driving conditions, even a seemingly small disparity in travel distance translates into a significant burden for Latinos seeking treatment. The distances identified in this study are almost triple the 1-mile threshold representing reduced access to treatment as determined by Beardsley et al. (2003).

The use of representative census data of the Latino population and the outpatient SUD treatment system in L.A. County supports the generalizability of our findings to the demography of Latinos and geography of SUD facilities in L.A. County. In addition, the analytic method used here can be, to a certain extent, applied to data collected from highly urban and sprawled metropolitan areas in other parts of the world with large concentrations of ethnic minorities with a significant need for health and social services.

Limitations and future directions

This study identified specific communities that may be both demographically and geographically in need of Spanish-language treatment services. However, there are a few issues to consider when interpreting our findings. Due to the nature of the existing data, the

current analysis considers place of residence and does not account for "daily activity spaces" (Guagliardo, 2004). For example, individuals may be more concerned about travel distance from their place of employment as opposed to their residence. Also, this analysis uses travel distance (in mileage) as a measure and does not consider travel time, which is a function of the network of freeways and roads used to travel to any given facility, as well as the availability of transportation (private or public) and other factors (e.g. speed limits, peak travel hours, traffic). Despite these challenges, the data and methods used here allowed us to identify preliminary evidence of travel burden in distinct areas of L.A. County.

It is important to note that due to the inherent nature of spatial data, this type of analysis is sensitive to the effects of scale and aggregation (Longley et al., 2005). The boundaries of census tracts –used as a proxy for Latino communities – are designated arbitrarily by the Census Bureau and do not depict particular communities. Yet, the use of census tract data is common in this type of analysis to describe demographic density (Higgs, 2004). Finally, although by focusing on outpatient SUD treatment, this study excludes other types of treatment options that are used by Latinos, such as 12-step programmes and hospital rehabilitation (Perron et al., 2009), outpatient treatment accounts for more than 70% of the Latino population entering SUD treatment (SAMHSA, 2009).

Despite these limitations, this study makes important contributions to the literature on the spatial distribution of outpatient services for an understudied population. The research to date has been primarily descriptive and exploratory, providing a foundation for theory development and theoretically informed hypotheses. An important direction for future research is to consider the spatial distribution of linguistically responsive treatment services over time. Given the reliance on family and close social networks within the Latino community, one may posit that family and peer support groups (e.g. 12-step groups) will be more likely to be established in hot spots. This traditional orientation may allow Latino communities to play an active role in meeting the health care needs of the broader community. The cross-sectional focus of the existing research will continue to be the primary barrier to the development of more dynamic and ecologically valid models.

Another important direction for future research is the integration of GIS with social networks. This would account for both the role of location of services and the influence of network members (e.g. family and peers) on service utilization. One may posit various interaction effects among key social network concepts (e.g. social network diversity and density) with distance to services. For example, more dense social networks may result in greater pressures or coordinated efforts to attend services, but these network influences may vary depending on the distance to services.

Conclusions and implications

This study allowed us to refine our examination of access to outpatient services in Spanish, revealing geographic areas with a high need to develop service capacity. The fact that Latinos have the highest use of alcohol and methamphetamine in CA (Fosados et al., 2007), coupled with a significant need for services in Spanish, makes it highly important for the largest publicly funded outpatient SUD treatment system in the nation to comply with federal and state laws by increasing the availability of linguistically responsive services in

the identified geographic areas. Increasing access to services certainly relies on multiple client and programme-level factors. Yet, reducing travel distance to needed SUD treatment services is a promising approach associated not only with increased client attendance, but also with rates of treatment completion (Beardsley et al., 2003; Fortney et al., 1995; Schmitt et al., 2003). This finding is consistent with international research that examined geographic distribution of drug treatment programmes. Specifically, Pang and Lee (2008) analyzed the geographic distribution of methadone maintenance programmes in Hong Kong using GIS. They concluded that the number of methadone clinics is as important as their locations, making geographic coverage a key consideration for monitoring harm reduction (Pang & Lee, 2008; also see Wong, Lee, & Lin, 2010).

Implications of this study are evident for current U.S. health care legislation, which seeks to enhance access to health care for millions of uninsured people. Considering that many of these people are low-income Spanish-speaking citizens, drug policy should focus on building capacity in L.A. County to meet the linguistic, cultural, and therapeutic service needs of its largest ethnic minority population, particularly in the geographic areas identified in this paper. Finally, the methodologies and data used in this paper can guide future studies examining the demographic distribution of racial/ethnic minorities and the geographic location of needed health and social services within large urban environments.

Acknowledgments

References

American Community Survey. Five-year estimates of language spoken at home and limited English proficiency for Latinos living in Los Angeles County. 2010. <http://www.census.gov/acs/www/data_documentation/data_main/>

Andrulis, DP.; Siddiqui, NJ.; Purtle, JP.; Duchon, L. Patient Protection and Affordable Care Act of 2010: Advancing health equity for racially and ethnically diverse populations. Washington, DC: Joint Center for Political and Economic Studies; 2010.

Anselin L. Local indicators of spatial association—LISA. Geographical Analysis. 1995; 27 (2):93–115. http://dx.doi.org/10.1111/j.1538-4632.1995.tb00338.x.

Anselin L, Syabri I, Kho Y. GeoDa: An introduction to spatial data analysis. Geographical Analysis. 2006; 38(1):5–22. http://dx.doi.org/10.1111/j.0016-7363.2005.00671.x.

Beardsley K, Wish ED, Fitzelle DB, O'Grady K, Arria AM. Distance traveled to outpatient drug treatment and client retention. Journal of Substance Abuse Treatment. 2003; 25(4):279–285. http://dx.doi.org/10.1016/S0740-5472(03)00188-0. [PubMed: 14693257]

Caetano R, Ramisetty-Mikler S, Rodriguez LA. The Hispanic Americans Baseline Alcohol Survey (HABLAS): Rates and predictors of alcohol abuse and dependence across Hispanic national groups. Journal for the Study of Alcohol and Drugs. 2008; 69(3):441–448.

Campos, M.; Yang, J.; Urada, D.; Hunter, J.; Tiburcio, N. Proposition 36 special populations: Hispanic men under 26. Los Angeles, CA: University of California; 2009.

Crèvecoeur D, Finnerty B, Rawson RA. Los Angeles County Evaluation System (LACES): Bringing accountability to alcohol and drug abuse treatment through a collaboration between providers, payers and researchers. Journal of Drug Issues. 2002; 32(3):865–879.

De La Rosa MR, Holleran LK, Rugh D, MacMaster SA. Substance abuse among U.S. Latinos: A review of literature. Journal of Social Work Practice in the Addictions. 2005; 5(1–2):1–20. http://dx.doi.org/10.1300/J160v5n01_01.

Esri. ESRI data & maps: StreetMap USA Release 9.2 [DVD]. Redlands, CA: Esri; 2006.

Esri. ArcGIS 10. 2011a. <http://www.esri.com/software/arcgis/arcgis10/index.html>

Esri. ArcGIS network analyst: Overview. 2011b. <http://www.esri.com/software/arcgis/extensions/networkanalyst/index.html>

Fortney JC, Booth BM, Blow FC, Bunn JY, Loveland Cook CA. The effects of travel barriers and age on the utilization of alcoholism treatment aftercare. American Journal of Drug and Alcohol Abuse. 1995; 21(3):391–406. http://dx.doi.org/10.3109/00952999509002705. [PubMed: 7484987]

Fosados R, Evans E, Hser YI. Ethnic differences in utilization of drug treatment services and outcomes among Proposition 36 offenders in California. Journal of Substance Abuse Treatment. 2007; 33(4): 391–399. http://dx.doi.org/10.1016/j.jsat.2007.02.005. [PubMed: 17499958]

Friedmann PD, D'Aunno TA, Jin L, Alexander JA. Medical and psychosocial services in drug abuse treatment: Do stronger linkages promote client utilization? Health Services Research. 2000; 35(2): 443–465. [PubMed: 10857471]

Galea S, Nandi A, Vlahov D. The social epidemiology of substance use. Epidemiologic Reviews. 2004; 26(1):36–52. http://dx.doi.org/10.1093/epirev/mxh007. [PubMed: 15234946]

GeoDa Center for Geospatial Analysis and Computation. OpenGeoDa project page. 2011. <http://geodacenter.asu.edu/projects/opengeoda>

Glick, R.; Moore, JE., editors. Drugs in Hispanic communities. New Brunswick, NJ: Rutgers University Press; 1996.

González HM, Vega WA, Tarraf W. Health care quality perceptions among foreign-born Latinos and the importance of speaking the same language. Journal of the American Board of Family Medicine. 2010; 23(6):745–752. http://dx.doi.org/10.3122/jabfm.2010.06.090264. [PubMed: 21057070]

Guagliardo MF. Spatial accessibility of primary care: Concepts, methods and challenges. International Journal of Health Geographics. 2004; 3:3. http://dx.doi.org/10.1186/1476-072X-3-3. [PubMed: 14987337]

Guerrero EG. Managerial capacity and adoption of culturally competent practices in outpatient substance abuse treatment organizations. Journal of Substance Abuse Treatment. 2010; 39(4):329–339. http://dx.doi.org/10.1016/j.jsat.2010.07.004. [PubMed: 20727703]

Guerrero EG, Andrews CM. Cultural competence in outpatient substance abuse treatment: Measurement and relationship to wait time and retention. Drug and Alcohol Dependence. 2011; 119(1–2):e13–e22. http://dx.doi.org/10.1016/j.drugalcdep.2011.05.020. [PubMed: 21680111]

Guerrero EG, Pan KB, Curtis A, Lizano EL. Availability of substance abuse treatment services in Spanish: A GIS analysis of Latino communities in Los Angeles County, California. Substance Abuse Treatment, Prevention, and Policy. 2011; 6:21. http://dx.doi.org/10.1186/1747-597X-6-21.

Higgs G. A literature review of the use of GIS-based measures of access to health care services. Health Services and Outcomes Research Methodology. 2004; 5(2):119–139. http://dx.doi.org/10.1007/s10742-005-4304-7.

Jani JS, Ortiz L, Aranda MP. Latino outcome studies in social work: A review of the literature. Research on Social Work Practice. 2009; 19(2):179–194. http://dx.doi.org/10.1177/1049731508315974.

Longley, PA.; Goodchild, MF.; Maguire, DJ.; Rhind, DW. Geographic information systems and science. 2. West Sussex, England: John Wiley & Sons; 2005.

McLafferty SL. GIS and health care. Annual Review of Public Health. 2003; 24:25–42. http://dx.doi.org/10.1146/annurev.publhealth.24.012902.141012.

Marsh JC, Cao D, Guerrero EG, Shin HC. Need-service matching in substance abuse treatment: Racial/ethnic differences. Evaluation and Program Planning. 2009; 32(1):43–51. http://dx.doi.org/10.1016/j.evalprogplan.2008.09.003. [PubMed: 19019434]

Office of Applied Research and Analysis. California outcomes measurement system: Treatment admissions, demographics. 2007a. <http://www.adp.ca.gov/oara/pdf/Demographics.pdf>
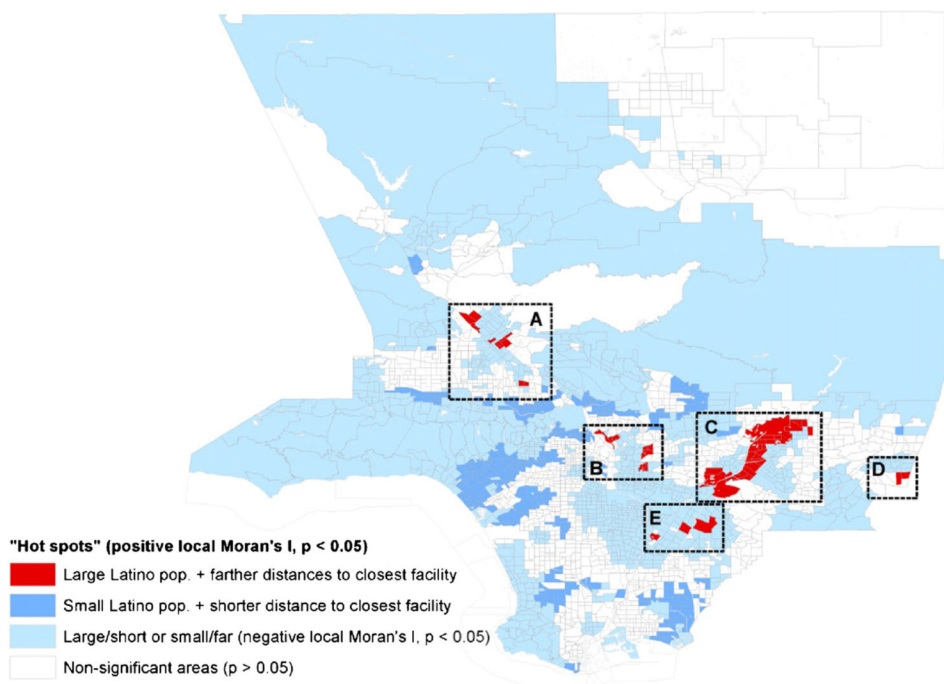
Office of Applied Research and Analysis. California outcomes measurement system: Service utilization, completion rates. 2007b. <http://www.adp.ca.gov/oara/pdf/Completion_Rates.pdf>

Pang TTP, Lee SS. Measuring the geographic coverage of methadone maintenance programme in Hong Kong by using geographic information system (GIS). International Journal of Health Geographics. 2008; 7:5. http://dx.doi.org/10.1186/1476-072X-7-5. [PubMed: 18234088]

Perron BE, Gillespie DF, Alexander-Eitzman B, Delva J. Availability of outpatient substance use disorder treatment programs in the United States. Substance Use and Misuse. 2010; 45(7–8):1097–1111. [PubMed: 20441453]

Perron BE, Mowbray OP, Glass JE, Delva J, Vaughn MG, Howard MO. Differences in service utilization and barriers among blacks, Hispanics, and whites with drug use disorders. Substance Abuse Treatment, Prevention, and Policy. 2009; 4:3. http://dx.doi.org/10.1186/1747-597X-4-3.

Schmidt LA, Ye Y, Greenfield TK, Bond J. Ethnic disparities in clinical severity and services for alcohol problems: Results from the National Alcohol Survey. Alcoholism: Clinical and Experimental Research. 2007; 31(1):48–56. http://dx.doi.org/10.1111/j.1530-0277.2006.00263.x.

Schmitt SK, Phibbs CS, Piette JD. The influence of distance on utilization of outpatient mental health aftercare following inpatient substance abuse treatment. Addictive Behaviors. 2003; 28(6):1183–1192. http://dx.doi.org/10.1016/S0306-4603(02)00218-6. [PubMed: 12834661]

Shorkey C, Windsor LC, Spence R. Assessing culturally competent chemical dependence treatment services for Mexican Americans. Journal of Behavioral Health Services and Research. 2008; 36(1):61–74. http://dx.doi.org/10.1007/s11414-008-9110-x. [PubMed: 18528760]

Substance Abuse and Mental Health Services Administration. Drug abuse warning network: Development of a new design: Methodology report. Rockville, MD: Office of Applied Studies, Substance Abuse and Mental Health Services Administration; 2002. (DHHS Publication No. (SMA) 02-3754)

Substance Abuse and Mental Health Services Administration. The NSDUH Report: Substance use treatment need and receipt among Latinos. Rockville, MD: Office of Applied Studies, Substance Abuse and Mental Health Services Administration; 2009. (DHHS Publication No. (SMA) 08-4343)

Substance Abuse and Mental Health Services Administration. National Survey of Substance Abuse Treatment Services (N-SSATS): 2009: Data on substance abuse treatment facilities. Rockville, MD: Office of Applied Studies, Substance Abuse and Mental Health Services Administration; 2010. (DHHS Publication No. (SMA) 10-4579)

Ulmer, C.; McFadden, B.; Nerenz, DR., editors. Race, ethnicity, and language data: Standardization for health care quality improvement (Report of Subcommittee on Standardized Collection of Race/Ethnicity Data for Healthcare Quality Improvement). Washington, DC: National Academies Press; 2009.

United Way of Greater Los Angeles. Zip code databook for Los Angeles County Service Planning Area 3: San Gabriel Valley. 2007. <http://www.unitedwayla.org/getinformed/rr/research/demo/Documents/SPA3%20San%20Gabriel%20Valley.pdf>

U.S. Census Bureau. Summary file 1: 2000 census of population and housing. 2000a. <http://www.census.gov/prod/cen2000/doc/sf1.pdf>

U.S. Census Bureau. Summary file 3: 2000 census of population and housing. 2000b. <http://www.census.gov/prod/cen2000/doc/sf3.pdf>

U.S. Census Bureau. Cartographic boundary files: Census tracts. 2001. <http://www.census.gov/geo/www/cob/tr_metadata.html>

U.S. Census Bureau. Census bureau releases state and county data depicting nation's population ahead of 2010 census. 2009. <http://www.census.gov/newsroom/releases/archives/population/cb09-76.html>

U.S. Census Bureau. 2010 census TIGER/Line® Shapefiles. 2010. <http://www.census.gov/geo/www/tiger/tgrshp2010/tgrshp2010.html>

U.S. Census Bureau. 2010 census redistricting data (Public Law 94–171) summary files. 2011. <http://www.census.gov/rdo/data/2010_census_redistricting_data_pl_94-171_summary_files.html>

Vega WA, Karno M, Alegria M, Alvidrez J, Bernal G, Escamilla M, et al. Research issues for improving treatment of U.S. Hispanics with persistent mental disorders. Psychiatric Services. 2007; 58(3):385–394. http://dx.doi.org/10.1176/appi.ps.58.3.385. [PubMed: 17325113]

Wang PS, Berglund P, Olfson M, Pincus HA, Wells KB, Kessler RC. Failure and delay in initial treatment contact after first onset of mental disorders in the National Comorbidity Survey Replication. Archives of General Psychiatry. 2005; 62(6):603–613. [PubMed: 15939838]

Wells K, Klap R, Koike A, Sherbourne C. Ethnic disparities in unmet need for alcoholism, drug abuse, and mental health care. American Journal of Psychiatry. 2001; 158(12):2027–2032. http://dx.doi.org/10.1176/appi.ajp.158.12.2027. [PubMed: 11729020]

Williams DR, Collins C. Racial residential segregation: A fundamental cause of racial disparities in health. Public Health Reports. 2001; 116(5):404–416. [PubMed: 12042604]

Wong NS, Lee SS, Lin H. Assessing the spatial distribution of methadone clinic clients and their access to treatment. Harm Reduction Journal. 2010; 7:14. http://dx.doi.org/10.1186/1477-7517-7-14. [PubMed: 20602756]
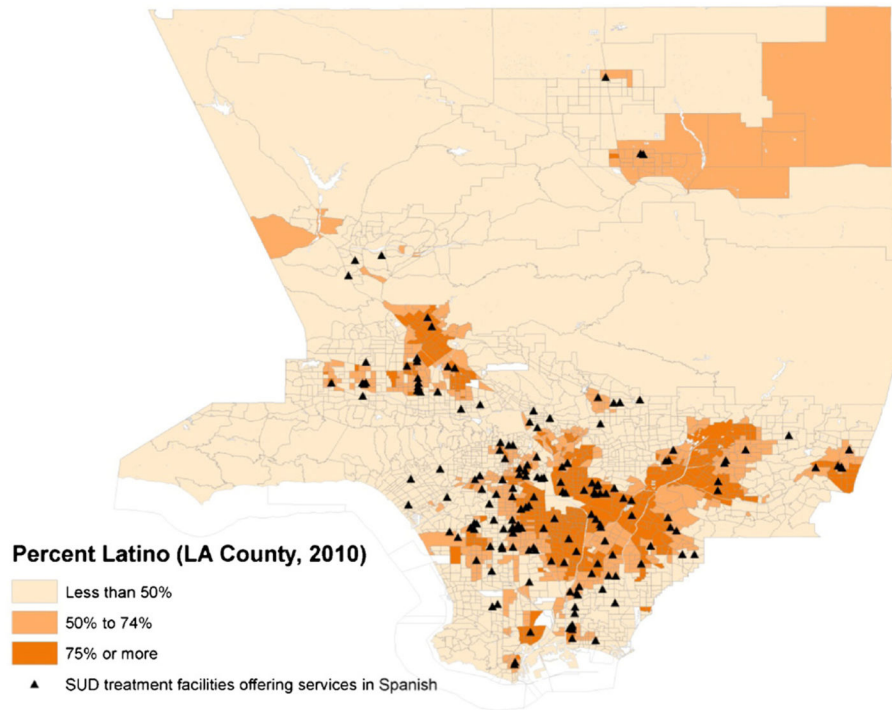
Fig. 1.
Map of Latino communities and outpatient SUD treatment facilities offering services in Spanish in Los Angeles County.

"Hot spots" (positive local Moran's I, p < 0.05)

- ■ (red) Large Latino pop. + farther distances to closest facility
- ■ (dark blue) Small Latino pop. + shorter distance to closest facility
- ■ (light blue) Large/short or small/far (negative local Moran's I, p < 0.05)
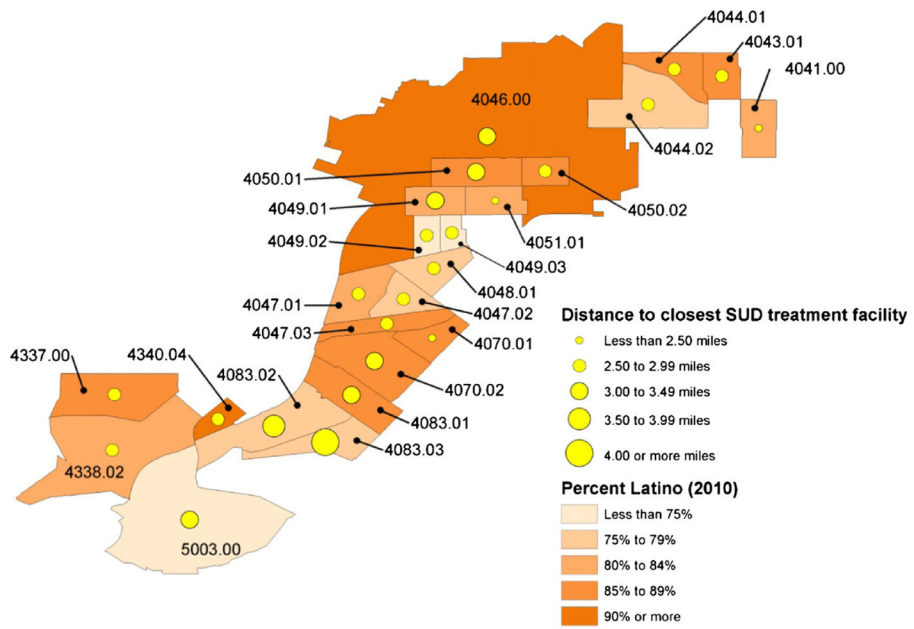- □ Non-significant areas (p > 0.05)

Fig. 2.
Map of the Latino population and travel distances to closest outpatient SUD treatment facility offering services in Spanish in L.A. County by "hot spot".
Note. Identified hot spots are based on the results of spatial autocorrelation analysis and represent areas of statistically significant clustering of neighbouring census tracts.

Fig. 3.
Map of the Latino population and travel distances to closest outpatient SUD treatment facility offering services in Spanish in hot spot C by census tract.

Table 1

Latino population and travel distance to closest outpatient SUD treatment facility offering Spanish-language services in Los Angeles County by hot spot regions.

Regions	Tracts (*n*)	Total population	Latino population	Percent Latino	Miles to closest facility *M* (SD)
Los Angeles County	2334	9,811,711	4,685,170	47.80%	2.28 (2.60)
Hot spot regions	51	214,380	175,966	82.10%	2.74 (0.38)
Hot spot A (L.A., San Fernando)	11	43,707	37,763	86.40%	2.59 (0.27)
Hot spot B (L.A., East L.A.)	11	33,419	27,715	82.90%	2.58 (0.25)
Hot spot C (South El Monte, Baldwin Park, Irwindale)	24	107,037	87,584	81.80%	2.93 (0.41)
Hot spot D (Pomona)	2	10,583	8335	78.80%	2.37 (0.21)
Hot spot E (Santa Fe Springs)	3	19,634	14,569	74.20%	2.65 (0.00)

L.A., Los Angeles; SD, standard deviation. Hot spot regions were assessed based on the spatial autocorrelation analysis and are shown in Fig. 2.

Table 2

Latino population and travel distance to closest outpatient SUD treatment facility offering Spanish-language services in hot spot C by census tracts.

Census tracts in hot spot C	Total population	Latino population	Percent Latino (%)	Distance to closest facility (miles)
4041	6445	5204	80.7	2.36
4043.01	5665	4912	86.7	2.74
4044.01	3979	3396	85.3	2.91
4044.02	5107	4029	78.9	2.91
4046	1422	1288	90.6	3.36
4047.01	5873	4834	82.3	2.76
4047.02	5882	4460	75.8	2.81
4047.03	3178	2816	88.6	2.82
4048.01	7305	5595	76.6	2.55
4049.01	5658	4564	80.7	3.32
4049.02	3973	2855	71.9	2.99
4049.03	2905	2169	74.7	2.59
4050.01	6170	5459	88.5	3.08
4050.02	3197	2830	88.5	2.72
4051.01	5304	4303	81.1	2.36
4070.01	5905	5217	88.3	2.41
4070.02	3804	3309	87	3.02
4083.01	5427	4654	85.8	3.11
4083.02	4036	3206	79.4	3.5
4083.03	4029	3111	77.2	4.19
4337	3294	2858	86.8	2.72
4338.02	2780	2278	81.9	2.98
4340.04	2796	2532	90.6	2.74
5003	2903	1705	58.7	3.47

Note. Census tracts for hot spot C are shown in Fig. 3.