

THEORY & POLICY

PUBLIC TRANSPORTATION
AND ACCESS TO HEALTHCARE:
A Case Study of
East Los Angeles and
the West San Gabriel Valley

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ABSTRACT

This paper examines the importance of public transportation for access to healthcare services. Using patient data and information on the existing spatial distribution of healthcare services and the public transportation network, this article argues that the geography of health, as well as socioeconomic status and demographic indicators, should be utilized in transit planning to improve access to healthcare services, especially in low-income communities. Focusing on the East Los Angeles and West San Gabriel communities in Southern California, the paper analyzes the current and potential usage of public transportation among patients in these socially and culturally diverse neighborhoods. Through spatial analysis and qualitative research, the article illustrates the reasons and methods for, and importance of, creating “healthcare transit corridors,” which could improve the level of access to healthcare facilities in particular urban neighborhoods.

Keywords: Transportation, Healthcare Transit Corridors, East Los Angeles

INTRODUCTION

During the last Metropolitan Transit Authority (MTA) strike in 2003, it became clear to many residents of Los Angeles that transit services are as crucial for access to healthcare as they are for getting to work. Indeed, a large number of low-income residents rely on public transit to reach health services in the metropolitan area. While this situation is clear to anyone who rides buses that stop at major public health facilities, the degree to which public transit is used to reach doctors, health clinics, and hospitals is unknown. For example, the most recent California Health Interview Survey (CHIS) suggests that among the nearly 900,000 Californians statewide who use public transportation, paratransit, and transportation provided by health service providers, nearly half are below the poverty level and 83.5% are below 200% poverty level

(Source: CHIS, 2008, computed by the author). However, similar information is unavailable at the county level or smaller geographic units, where planning intervention could facilitate targeted solutions. Despite this data limitation, which applies to California and other states as well, the literature about transit service and its impact on health and access to healthcare is growing in volume. This is partially driven by the growing realization that access to health services is vital to low-income populations and that research on this facet of public transportation could translate to an overall improvement in the health and well-being of these communities.

Realizing the importance of mobility in accessing health services, this paper attempts to illustrate the importance of further research into the structural connection between public transportation and health, while offering a methodology for assessing the role of transit service in access to health services and arguing for the creation of healthcare transit service corridors. Given the role of land use and zoning in producing the geography of healthcare facilities, the creation of such targeted transit service corridors may prove effective in improving access to health services without imposing a significant cost on regional and local transit providers. As illustrated later in this paper through a GIS-based analytical process, existing services and future expansions can be aligned to serve both the commuting and the health service access needs of various communities.

BACKGROUND

A 2004 report on *Infant Mortality Among African Americans in Antelope Valley* (located in the northern section of Los Angeles County) suggested that a barrier to healthcare access was the limited nature of transportation services (Davenport and Harding, 2004). The specific complaint voiced by this report indicates that transit planning must take into account issues other than commuting in designing the overall system:

While the area has its own transportation agency as part of the Metropolitan Transit Authority, transportation around the valley is limited and geared for transporting most riders out of the area in the morning to work and returning in the evening. Midday transportation needed to access health care appointments is limited. (p. 5)

The importance of transit in improving access to healthcare, and thus the health and well-being of communities, has been documented in other regions of the country as well. For example, in a study of children's medical appointments that were missed at the Texas Children's Hospital Residents' Primary Care Group - RPCG Clinic, researchers were able to document that the level of access to mass transit systems influenced the number of missed appointments (Yang et al., 2004). Since income level was also found to have a direct influence on the number of missed appointments, the study suggests that access to transit services may be of particular importance to low-income, minority populations with limited access to automobiles. In the case of the Antelope Valley communities and other similar regions, the impact is particularly evident for women and children. This problem has been documented in the case of rural (Hubbell, 2006), as well as urban, areas (Buki et al., 2004), where inadequate access to transportation can prove detrimental to the health and well-being of women.

The negative impacts of inadequate access to transportation on low-income communities do not appear to be limited to a particular region or to specific racial and ethnic groups. From Massachusetts (e.g., Flores et al., 1998) and West Virginia (e.g., Walter, et al., 2004) to Texas (e.g., King et al., 2009; Strover et al., 2004), New Mexico (e.g., Hubbell, 2006) and California (e.g., Balfour & Kaplan, 2002), a growing number of researchers are connecting access to healthcare facilities and health outcomes with

transportation. Results indicate that in the most vulnerable populations, such as those with various disabilities and the elderly, this lack of transportation options can have a pronounced impact on their overall well-being (Fitzpatrick et al., 2004; Balfour & Kaplan, 2002).

The severity of this problem and its effect on children is also of particular concern. On May 3, 2007, an article in *USA Today* (Wolf, 2007) reported that, nationally, an estimated 3.2 million children cannot go to dentists, doctors, and hospitals due to transportation problems. Flores et al. (1998), in their study of Latinos at a Boston clinic, discovered that 21% of parents cited transportation as a reason for not bringing their children to the clinic for medical visits. Their reasons included the expense and inconvenience of public transportation for reaching medical facilities.

The seriousness of the problem posed by a lack of access to efficient and appropriate levels of public transportation to health outcomes was documented by Lucas (2006), who reported that the 2004 Transportation White Paper Policy in the U.K. prioritized this issue at the national level. The author pointed out that as "[h]ospitals and health services are being rationalised into fewer, larger units serving wide areas and located in places that are difficult to reach without a car" (p. 802), accessing these facilities becomes "...particularly difficult for people who have to rely on public transport, leading to failed health appointments and associated delays in medical interventions" (p. 802). A similar condition exists in the United States. As budget woes begin to affect the operational quality of smaller/local clinics and as reliance on regional hospitals increases, the inadequacy of public transportation may further exacerbate the level of access to healthcare services, especially among low-income minorities, the elderly population, and children.

The inadequacy of attention paid to the connection between public transportation and access to health is evident by the scant (but growing) literature on this topic in transportation planning journals. In fact, a hand-

ful of articles that deal with this topic typically appear in health and social policy journals and in many cases have been advanced by the expansion of health research, using geographic information systems (GIS). Martin et al. (2002) summarized some of the earlier methodological work on this topic. While focusing on access measurement in rural healthcare, the authors point to the earlier works of Joseph and Phillips (1984), Ball and Fisher (1994), Love and Lindquist (1995), Boyle et al. (1996), Jones and Bentham (1998), Martin et al. (1998), Parker and Campbell (1998), Gatrell and Senior (1999), Lovett et al. (2000), and Spiekermann and Wegener (2000). These studies provided some of the earlier methodologies for assessing actual and potential access to healthcare facilities. Attention to this topic has also meant that a number of researchers have engaged in analyses that attempt to identify optimal locations for health facilities vis-à-vis public transportation networks (e.g., Martin et al., 2002). While the latter study explicitly included public transportation in the study of the rural South West of England, a number of other studies remain concerned with overall transportation issues (e.g., Zhang et al., 2009) and urban/rural connectivity or distance from facilities. Regardless of their particular emphases, these studies systematically illustrate the importance of placing health outcomes and quality of life measurements within the context of physical access to healthcare facilities. This issue has also been raised on occasion by transportation planning researchers advocating for better integration of health and transportation planning (e.g., Hull, 2005; Sallis et al., 2004). This focus on integration is particularly important if we are to overcome some of the structural inequities facing low-income and minority populations. The advocacy for increased attention to access to healthcare facilities in public transportation planning follows previous discussions regarding the importance of non-commuting trips in daily household travel patterns. As in the case of shopping areas, the fixed location of hospitals, clinics, and medical offices and their relationship to zon-

ing and land use patterns should make the task of route planning (including determining the location of stops and headways) manageable.

To advance the transportation planning perspective on this topic, this paper focuses on a case study of East Los Angeles and West San Gabriel Valley communities (located in Southern California), illustrating how transit planning analyses might benefit from incorporating patient data in establishing what we will call healthcare transit corridors. Beyond the quantitative assessment and GIS analyses, our research included community input through focus group meetings, allowing us to assess transit connectivity and its importance in improving access to health services in the targeted communities. In our analysis, we included not only regional transit routes (i.e., Metropolitan Transportation Authority – MTA) but also local transit services (i.e., El Sol and Dash) in order to provide a more comprehensive picture of how access to healthcare services could be improved by integrating and coordinating the activities of various providers.

DATA AND FINDINGS

Our study focuses on 13 ZIP codes that make up the East Los Angeles and West San Gabriel Valley communities, extending from Rosemead to Boyle Heights and the Northeast neighborhood and from Alhambra to Montebello (see Figure 1). We began this research by assembling a number of datasets, including the 2006 patient data from the Office of Statewide Health Planning and Development (OSHPD), the 2007 data from the California Health Interview Survey (CHIS), the American Medical Information – Info USA (AMI), Physicians and Surgeons, 2008, 2007 demographic estimates from Claritas Inc., and transit route operations by MTA, El Sol, and Dash.

Based on 2007 population estimates from Claritas Inc., the 146 census tracts that encompass the targeted area had a total population of about 666,000. Racial and ethnic data suggest that Latinos (65.6%) and Asian Pacific

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Islanders (API) (25.7%) constitute the majority, with other racial and ethnic groups making up less than 10% of the total population.

Our initial sociodemographic mapping illustrated that in the southwestern section, where Boyle Heights and East Los Angeles are located, a significant portion of the population consisted of young Latinos with low median household incomes and heavy reliance on public assistance (the lowest median household incomes are found in ZIP code 90033, where USC Hospital and White Memorial Medical Center are located). Conversely, the eastern section, covering Alhambra, Rosemead, Monterey, and Montebello, housed a slightly older and mostly Asian Pacific Islander population, where median household incomes are comparatively larger and a smaller segment of the population relies on public assistance.

DEMOGRAPHY OF HEALTH

The 2006 edition of the OSHPD provides a comprehensive picture of health outcomes for various sociodemographic groups and the communities where they reside. For the purpose of our research, we conducted a two-part analysis. The first part focused on individual records. This allowed us to compare the health conditions and demographic characteristics of patients in our target area with all patients in the county of Los Angeles. For the second analysis, we aggregated the individual patient data at the ZIP-code level to assess the geography of health outcomes, allowing us to use this information to assess accessibility and the potential usage of various transit routes.

Among the 1.2 million Los Angeles County patients in 2006,¹ slightly over 70,000 lived in the 13 ZIP codes that make up the targeted area. Information on the race and

ethnicity of these patients² reveals that Latinos make up about 41% of all patients in the county and 68% of those in the target area. These figures are comparable to the proportion of the Latino population within these geographies. Comparatively, API patients make up 6.8% and 20.2% of all patients in the county and the targeted areas, respectively. This means that, at the county level, the number of API patients is significantly smaller than their overall population proportion; and within the targeted area, API patients are only slightly underrepresented. In the case of both Latinos and APIs, female patients outnumber males. This is mostly explained by the number of patients who have been received by hospitals and clinics for child delivery.

While there are no socioeconomic variables available in the OSHPD dataset, proxies such as the types of insurance used by patients, including Medicare and Medi-Cal, will reveal the social structure of the target area.³ Among the nearly 1.2 million county patients, 30.5% used Medicare and another 30% used Medi-Cal. The former is used primarily by people over the age of 65 who are citizens or permanent residents. The latter is for people with similar citizenship status, but with lower incomes. While slightly over 60% of the patients are supported through these programs, another 31.4% use private insurance. In the target area, Medi-Cal is used at a much higher rate (38.8%), while private coverage declines to 21.9%. These factors point to the overall lower socioeconomic status of the population living in the selected ZIP codes.

GEOGRAPHY OF HEALTH OUTCOME AND HEALTHCARE SERVICES

OSHPD data provide in-depth information regarding diagnosis or the reason for which an individual visited

1 Each record in OSHPD data represents a single visit. Therefore, 1.2 million refers to patient visits. For brevity, however, we will use the word patients.

2 Race and ethnicity information was available for only 778,894 patients in the county and 50,238 in the targeted area.

3 Given that the data regarding “expected sources of payment” and “payment plan code” are extracted from the OSHPD database, this information simply refers to a subset of all residents and does not include information regarding all individuals in the target area.

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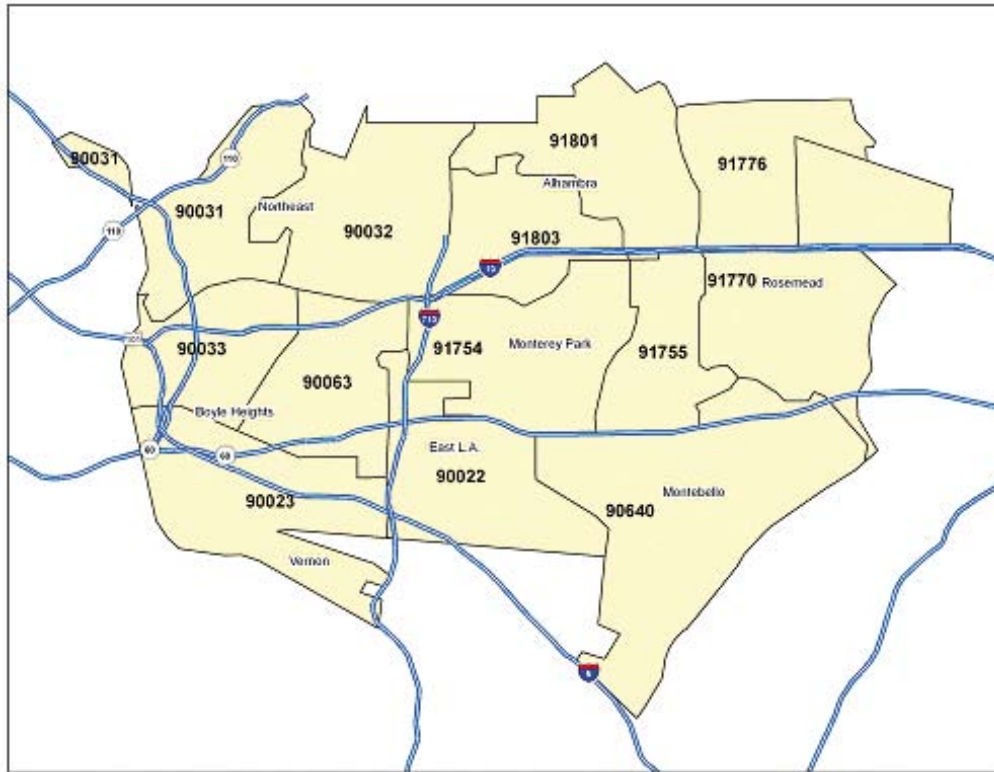


Figure 1. Target Area

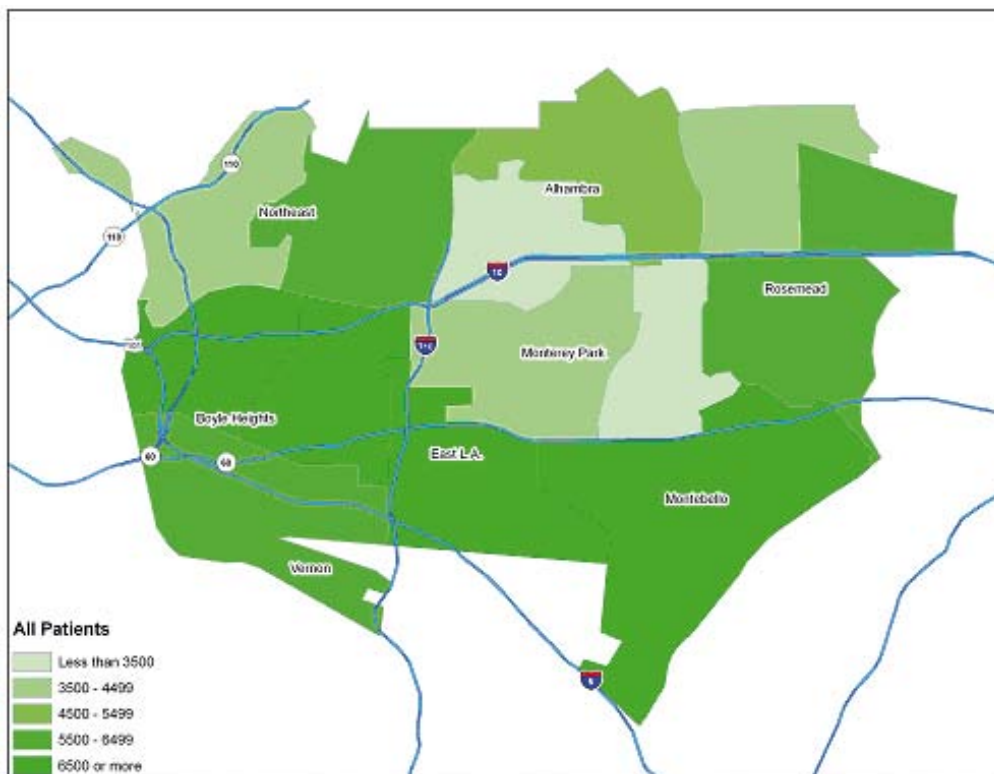


Figure 2. All Patients

Source: Patient Discharge Data, State of California Office of Statewide Health Planning and Development (OSHPD; 2006). Processed by the Author.

a healthcare facility. This information is organized under diagnosis-related groups (DRG) and Major Diagnostic Categories (MDC). This is a rich dataset that allows us to analyze the level of connectivity between patients with particular illnesses and the facilities where they were treated. This origin-destination data can be structured for citywide analysis of health geography and its associated transportation needs. Subsetting the data by racial, ethnic, gender, and age groups also allows us to conduct detailed studies of various subgroups and their particular transportation needs.

For the sake of brevity, we will not discuss the details of how health indicators vary by race and ethnicity. Instead, we will move directly to a geographic analysis of various DRGs and a study of how the spatial distribution of patients can help us analyze transit service operations and their potential utility in improving access to healthcare facilities. To conduct this analysis, we aggregated the patient records by their ZIP code of residence for selected demographic indicators and DRGs. We were primarily interested in the spatial distribution of patients by their racial and ethnic status (mainly Latinos and APIs in the targeted area), Medi-Cal and Medicare usage, and selected DRGs.

Figure 2 illustrates the distribution of all patients in the targeted area. Clearly, the largest number of patients live in four ZIP codes that extend from Boyle Heights to Montebello (i.e., 90033, 90063, 90022, and 90640). However, 60% or more of the patients in 90033, 90063, 90023, and 90022 are Latinos, and the largest percentages for APIs are found on the east side of the targeted area, in ZIP codes 91801, 91776, 91770, 91755, and 91754. This area includes Alhambra, Rosemead, and Monterey Park. This pattern illustrates the clear geographic division between Latino and API patients. The former reside mostly in the western and the latter in the eastern section of the targeted area, with the 710 freeway acting as the border between the two. The only exception is ZIP code 90031, where a larger number of APIs can be found on the west side.

Medicare and Medi-Cal usage patterns (Figure 3) also indicate the persistence of this geographic divide. While the areas home to a larger number of Latino patients illustrate a high percentage of Medi-Cal usage (i.e., ZIP codes on the west side, especially 90033, 90063, and 90023, which mostly cover Boyle Heights), ZIP codes 91803 and 91754 in Monterey Park and 91776 in the northeastern section of the targeted area have the highest rates of Medicare usage. Once again, this indicates a lower socioeconomic status in the western section of the target area and the higher presence of older age cohorts in the eastern section. This geographic divide can also be seen in the pattern of private insurance usage (or lack thereof).

Figure 4 illustrates the percentage of patients for whom the source of private insurance is unknown. Note that once again, ZIP codes 90033 and 90023 house the largest number of such patients. In terms of health disparities and potential health problems, the southwestern section of the targeted area is probably the most vulnerable. As such, not only do policies to remedy this traditional problem with access to healthcare services need to be considered, but the compounding effects of inadequate public transportation services also need to be examined and any observed problems must be addressed.

To provide a better understanding of patterns of health service needs (by category and volume), we mapped the distribution of patients in the targeted area by some of the major DRG categories. We will not display and describe each DRG; however, based on our analysis and findings, we will discuss a few that will help us think through health-specific public transportation needs.

Figure 5 displays the distribution of neonates with significant problems. The Northeast and East Los Angeles areas appear to have the largest concentrations for this DRG, accounting for nearly 34% of all the reported 1,101 cases in the target area in 2006. Because access to perinatal and neonate care is an important dimension of a healthy community, we will return to this topic later in this paper.

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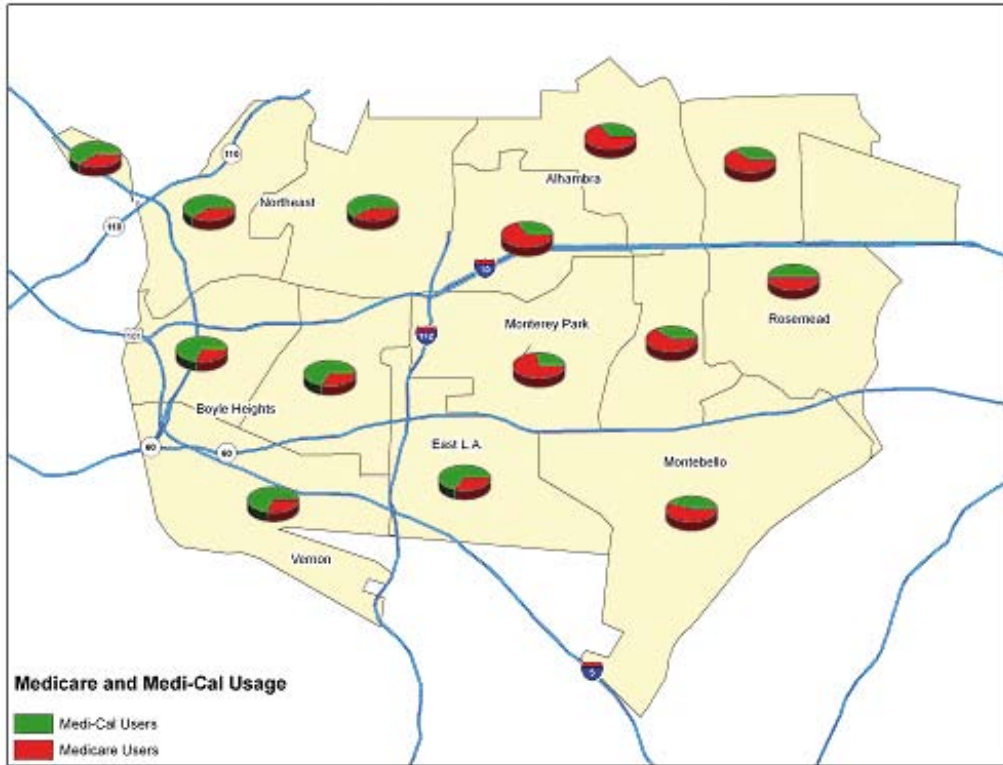


Figure 3.
Medicare Versus Medi-Cal Usage in the Target Area

Source: Patient Discharge Data, State of California Office of Statewide Health Planning and Development (OSHPD; 2006). Processed by the Author.

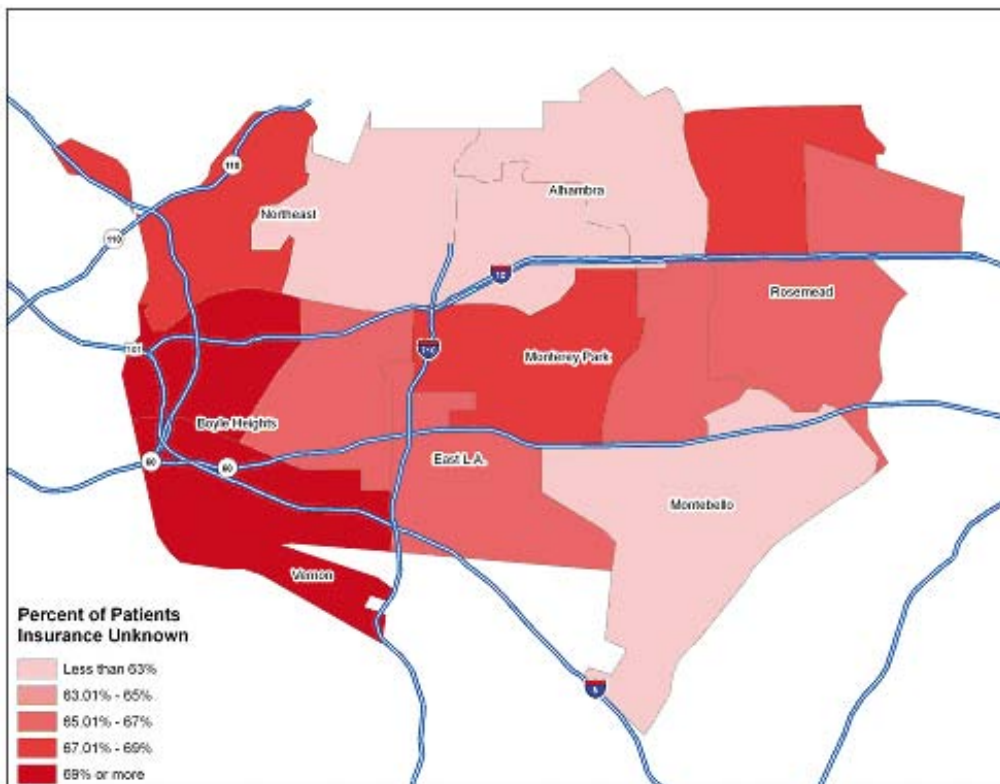


Figure 4.
Insurance Unknown

Source: Patient Discharge Data, State of California Office of Statewide Health Planning and Development (OSHPD; 2006). Processed by the Author.

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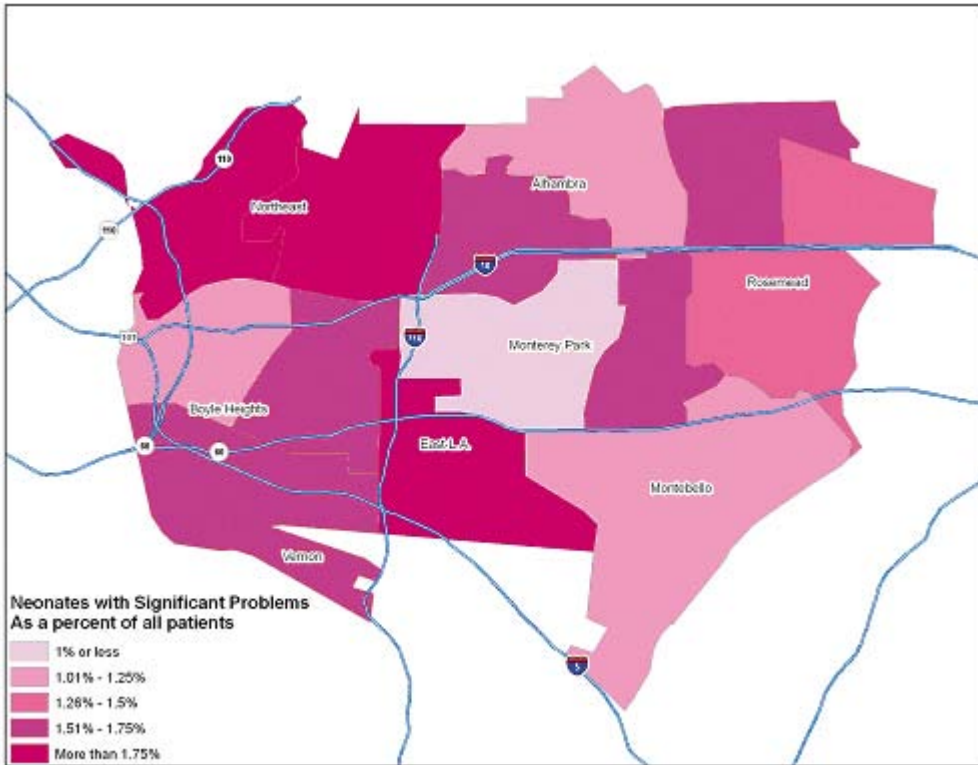


Figure 5.
Neonates with Significant Problems

Source: Patient Discharge Data, State of California Office of Statewide Health Planning and Development (OSHPD; 2006). Processed by the Author.

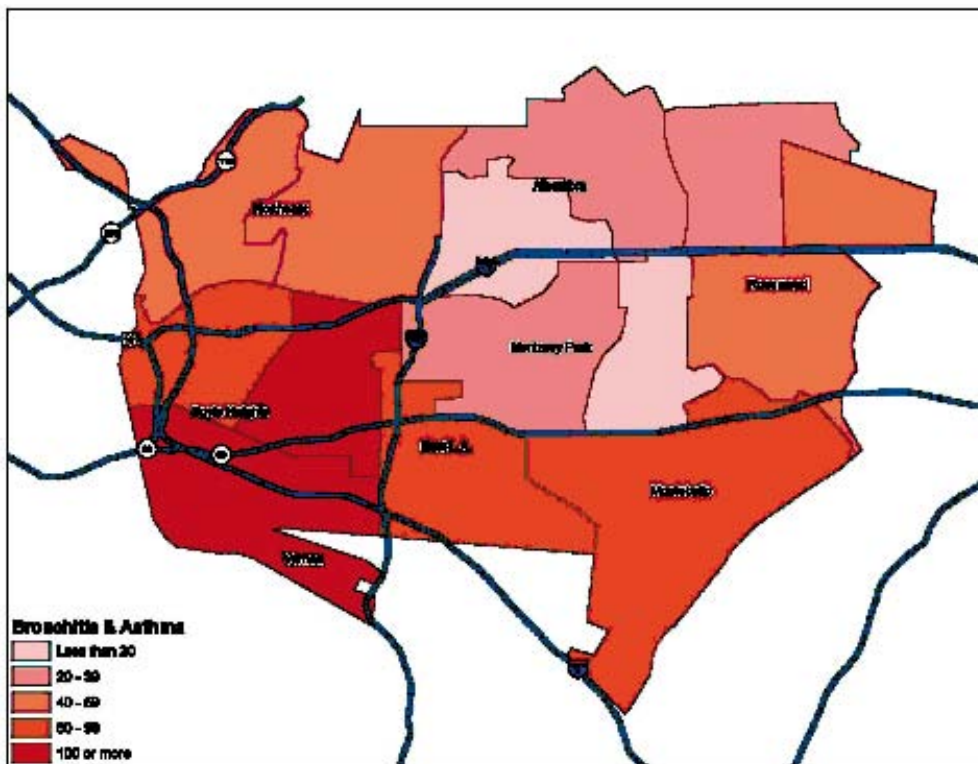


Figure 6.
All Cases of Bronchitis and Asthma

Source: Patient Discharge Data, State of California Office of Statewide Health Planning and Development (OSHPD; 2006). Processed by the Author.

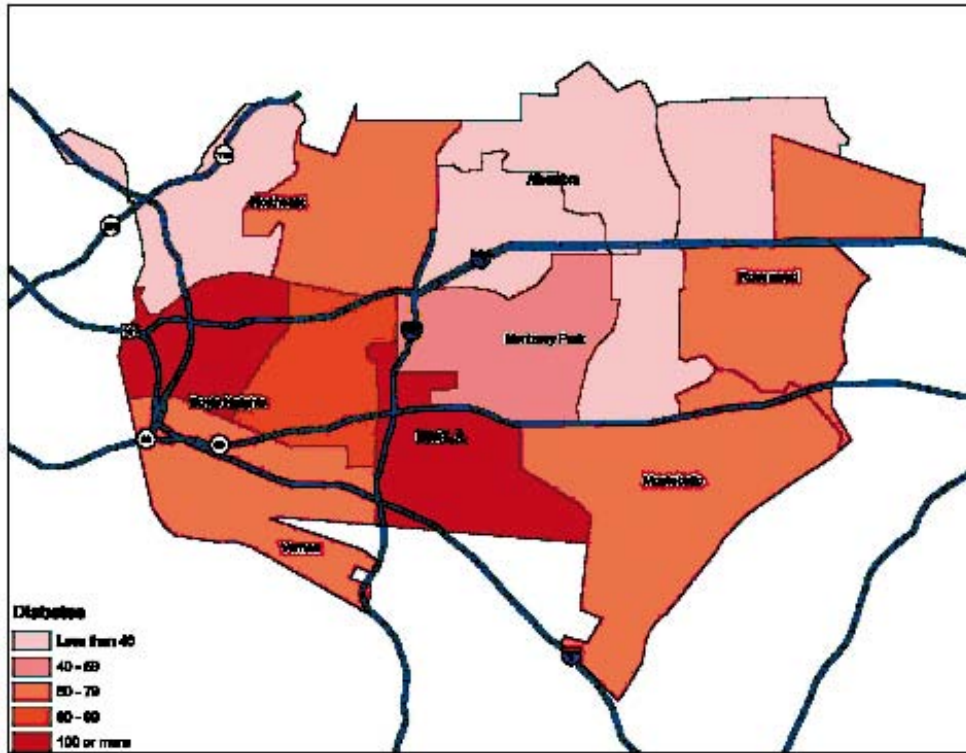


Figure 7.
All Cases of Diabetes

Source: Patient Discharge Data, State of California Office of Statewide Health Planning and Development (OSHPD; 2006). Processed by the Author.

Figure 6 displays the distribution of bronchitis and asthma in the targeted region. Overall, there were 840 cases of bronchitis in the 2006 database, 257 of which occurred in the two ZIP codes of 90023 and 90063. Among patients age 17 and younger who reside in Boyle Heights, this illness appears to occur more frequently. Older patients affected by bronchitis and asthma are more likely to live in Montebello and East Los Angeles.

Even though diabetes did not appear as a major DRG, the 130 cases among the population age 35 and younger and the 638 cases among those older than 35 suggest that ongoing care and education about this illness may be needed. Geographically, East Los Angeles and Boyle Heights appear to house the largest numbers of patients (see Figure 7), with ZIP code 90033 having housed 113 (about 15%) of the diabetic patients in the area. ZIP code 90022 housed an additional 100 patients. Though their numbers may seem small, it should be remembered that these are individuals who visited a hospital. In other words, these incidents

may not be simple check-up visits. Therefore, the observed pattern may simply be an indication of the geography of the worst cases and symptomatic of the severity of these problems. In fact, obesity and diabetes are major health concerns in East Los Angeles, as illustrated by the existence of a number of centers dedicated to these illnesses (e.g., East Los Angeles Center for Diabetes) and research on their causes and possible prevention (e.g., Kipke et al., 2007). Since many of those affected by obesity and diabetes are also members of low-income populations, the success rate of various educational and preventive initiatives could be improved by the provision of adequate and efficient public transportation services.

DISTRIBUTION OF HOSPITALS, PHYSICIANS, AND SURGEONS

For each patient record, OSHPD data identifies the healthcare facility where the person received care. For our analysis of the utility of public transportation in connecting

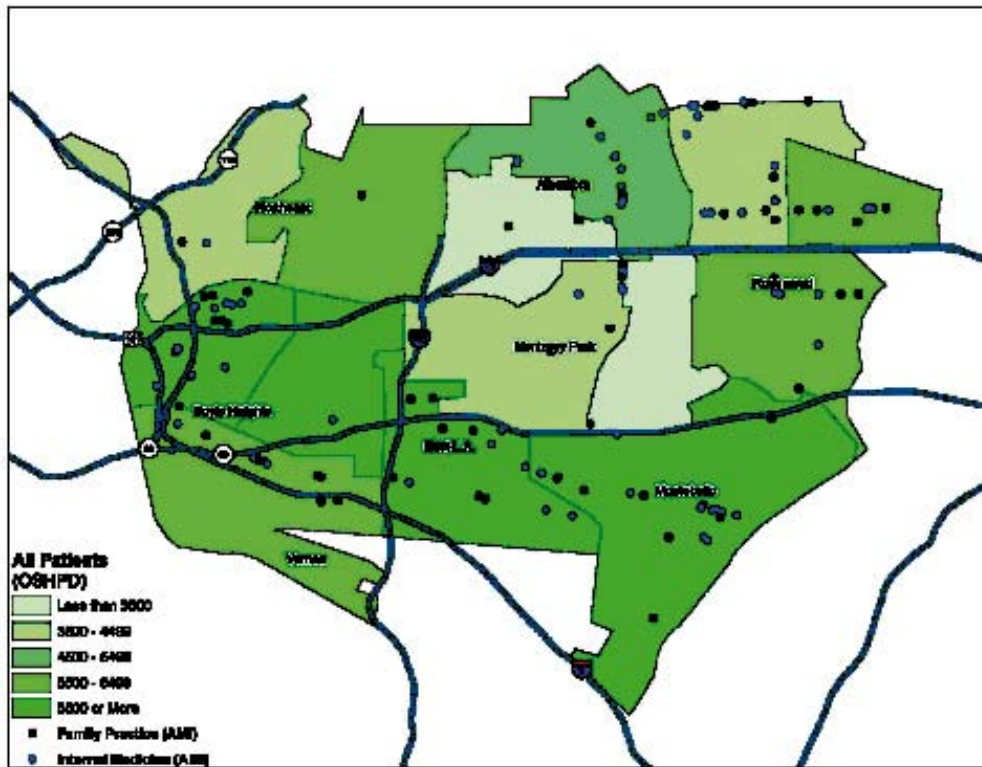


Figure 9.
Family Practice and Internal Medicine

Sources: American Medical Information, Info USA, 2008. Patient Discharge Data, State of California Office of Statewide Health Planning and Development (OSHPD; 2006). Processed by the Author.

These include family practice, internal medicine, and pediatrics. There were 153 doctors in family practice and another 257 were listed as specializing in internal medicine. These 410 doctors are distributed mostly in the eastern and southern sections of the target area. In fact, 7 of the 13 ZIP codes had fewer than 10 family practitioners, and 5 had fewer than 10 doctors specializing in internal medicine. ZIP codes having fewer than 10 doctors in either category are 90031, 90032, 91755, and 91803.

While there are 120 pediatricians practicing in the target area, over half are located in ZIP code 90033. There appears to be a mismatch between pediatric demand and the supply of pediatricians, especially from a geographic perspective. For example, while ZIP codes 90031, 90032, and 90022 have the highest incidents of neonate problems, only 6 pediatricians practice in these areas. Therefore, anyone living in the western section of the target area who requires prenatal or neonatal care must go to ZIP code 90033. In fact, 1,143 (61.5%) of the 1,859

doctors in the target area practice in this ZIP code. This means that an efficient mode of transportation is needed to connect residents of the target area to this particular ZIP code. In the absence of access to private automobiles in low-income areas such as the Northeast communities, the importance of providing reliable and efficient public transportation that connects patients to health service providers becomes crucial, directly affecting the health and well-being of the residents, especially children.

To illustrate the importance of certain ZIP codes in the target areas as centers of health service provision, we also ran an analysis on the OSHPD data. Of the 70,708 patients residing in this area, 65.7% (or 46,441) used one of the 14 facilities within the target area. Among these, 45.1% (or 20,967) used facilities in ZIP codes 90033 and 90023, with facilities in 90033 alone serving 17,640 patients. This information illustrates the degree to which the targeted communities rely on local service providers and underscores that in this area, ZIP code 90033 is a

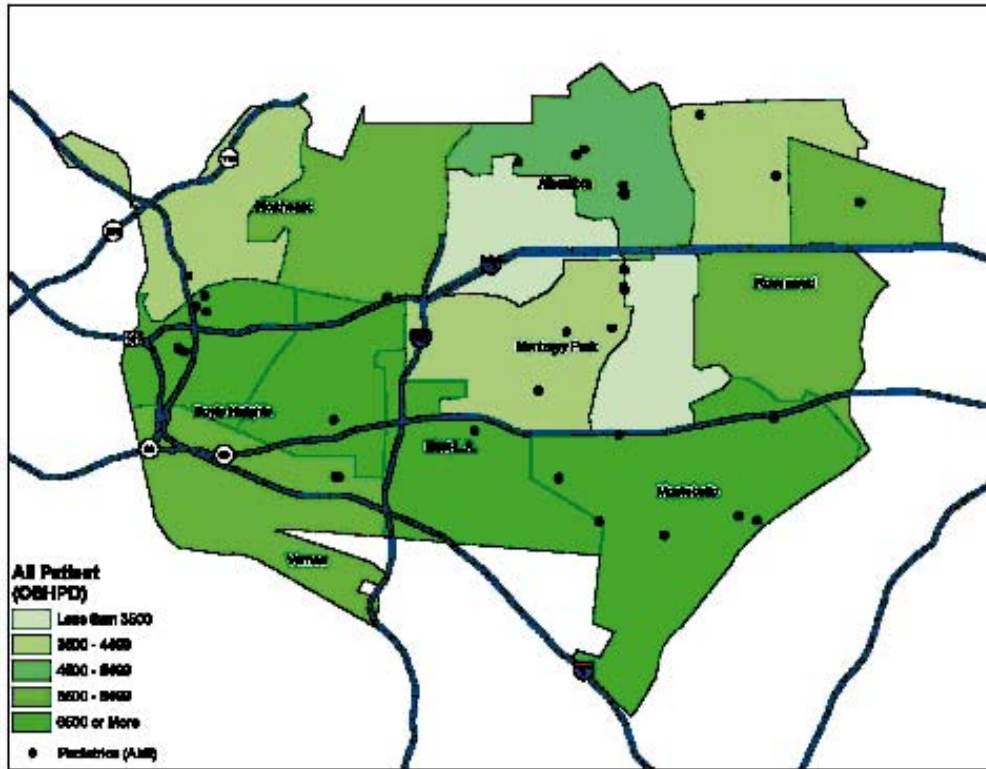


Figure 10. Pediatrics

Sources: American Medical Information, Info USA (2008); Patient Discharge Data, State of California Office of Statewide Health Planning and Development (OSHPD; 2006). Processed by the Author.

primary node for seeking and providing health services. This situation further suggests that this ZIP code must be seen as a major destination around which regional and local transportation planning, with an emphasis on access to healthcare services, should occur. ZIP code 91754, which caters to 11,133 patients, can be treated as the second node for designing a transportation system that meets the healthcare needs of the target area.

ASSESSING THE UTILITY OF THE PUBLIC TRANSPORTATION SYSTEM

Learning From the Community

As a part of this research, we sought public input regarding our initial findings and how best to proceed with the analysis of public transportation in the target area. To obtain this information, we held a workshop on our campus, inviting representatives from public and private sectors, nonprofits, and community-based organizations that deal with health and healthcare service

and are familiar with some of the challenges in the target area. After presenting our initial findings, we sought participants’ input regarding local transportation issues, particularly as they relate to access to healthcare services.

Even though a significant portion of the conversation focused on health issues and the spatial patterns of various DRGs, which helped us understand some of the dynamics shaping these particular geographies, attendees encouraged us to pay particular attention to local transit providers (i.e., moving beyond the two regional service providers, MTA and Foothill). They also informed us that in the absence of adequate access to public transportation, many local healthcare providers have created their own shuttle services.

To understand how community residents are using the existing public transportation services to reach healthcare facilities, we also conducted three focus group meetings (one in Spanish and two in English). Given our findings regarding socioeconomic conditions

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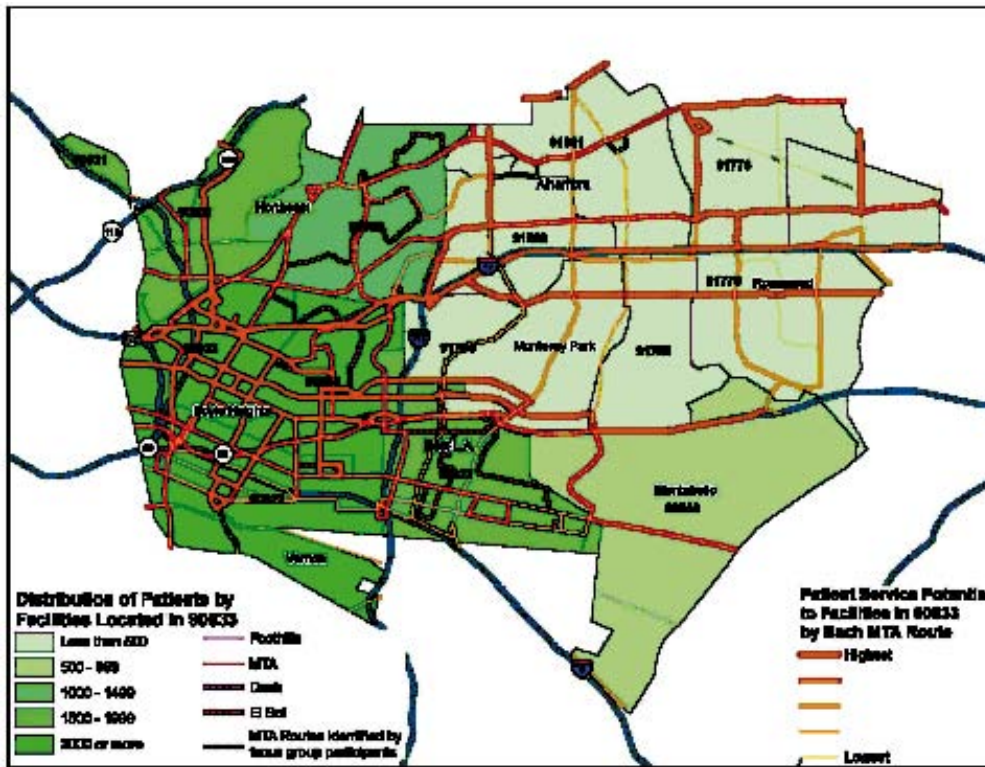


Figure 11.
Patient Service Potential to Healthcare Facilities in 90033 by MTA Routes

Source: Patient Discharge Data, State of California Office of Statewide Health Planning and Development (OSHPD; 2006). Processed by the Author.

in the southwestern section of the target area and some of the health challenges facing these communities, we conducted our focus group meetings with a total of 26 individuals from this area. The meetings ran for almost 2 hours each and included female residents between the ages of 17 and 57.

The following is a summary of our findings from these meetings, which clearly illustrate the importance of public transportation in reaching various health facilities and the challenges faced by patients residing in the targeted area:

- When going for regular doctor visits, many participants reported taking public transportation.
- The choice of transportation used by the participants is determined by a combination of factors: destination, costs of the method of transportation, and efficiency of the method of transportation.
- Financial considerations play a major factor in the selection of the public transportation method.

Participants preferred low-cost services provided by DASH or the “Solectito” (literally, “little sun,” which is the participants’ nickname for the “El Sol” East Los Angeles Shuttle bus service that charges only 25 cents).

- Bus routes and their stops are important factors when accessing healthcare.
- When participants had a limited time frame in which to reach a destination, they preferred the shorter travel time of the Metro Rapid. However, they indicated that there was too much distance between the Metro Rapid stops.
- Their biggest complaint about the El Sol Shuttle, DASH, and Metro buses in the area is that the buses are crowded and that there is often a long wait, making bus travel inefficient.
- Participants also complained that in some cases, when a bus route passes a healthcare facility, there is not necessarily a stop nearby.

- The public transportation service in El Sereno (ZIP Code 90032) seems limited. One participant observed that two buses go near her residence. However, they both go downtown, which is not where she always needs to go.
- While El Sol and Dash are used frequently, the following MTA routes were also mentioned by various participants:
 - 18, 30, 68, 251/252, 254, 605, and 720.

This information was used to conduct the next set of analyses, which focused on the public transportation network. This began with an estimation of potential patient ridership for each public transportation route (for MTA, El Sol, and Dash) and ranking them according to their level of accessibility and utility.

ANALYSIS OF POTENTIAL PATIENT RIDERSHIP

To illustrate the potential utility of public transportation for access to healthcare facilities, we narrowed the analysis to particular origin and destination information. Because facilities in ZIP codes 90033 and 91754 serve the largest number of patients, they are the de facto major destinations for a large portion of the patient population, allowing us to evaluate which routes may need to be considered most effective for reaching health service providers in the target area. The analysis focused on the geography of transit routes.

Using GIS, we conducted a network analysis of all transit routes, focusing primarily on our targeted ZIP Codes. For each of these two destinations, we constructed a dataset that isolated only those patients that used healthcare facilities in these ZIP codes. Each transit route was then assigned the number of patients it could potentially serve (using the distribution of the targeted patients). Therefore, for each ZIP code of destination, we were able to identify the potential loading pattern for various transit routes. Being fully aware that not all pa-

tients would use public transportation, even if an optimal service was provided, we used the loading patterns as a simple indication of the ranking for comparing various routes and health facilities they serve.

A total of 17,640 patients received healthcare in ZIP code 90033. As Figure 11 illustrates, the majority of these patients resided in ZIP codes 90033, 90063, 90023, 90022, 90031, and 90032 (ordered by the number of patients in each). Overall, 15,041, or 85.3% of all patients served in 90033 lived in these six ZIP codes, which cover the western section of the target area. Among those public transportation routes with the largest potential to serve ZIP code 90033, MTA routes 68, 70, and 60 were mentioned by the participants in our focus group meetings. It is interesting that our computation ranked route 68 as the second largest potential service provider. However, route 255, which travels in a north-south direction in the western section of the target area, was ranked first. Its omission from the discussions at our focus group meetings could be due to the mixture of the participants and where they reside (i.e., the southwestern section of the target area, where the route does not reach). A more prominent potential for routes that travel in an east-west direction suggests that cumulatively, these routes can serve a large number of commuters. However, it is crucial that their service be coordinated with local transit service providers and other MTA routes in order to deliver the potential patients to their healthcare destinations.

Among El Sol routes, the Union Pacific/Salazar Park (the one serving southwestern neighborhoods) route has the highest service potential for facilities in ZIP codes 90033 (see Figure 12). However, given that none of the three routes actually reaches 90033, this potential is fulfilled only if connections to other public transportation service providers are made (for example, combining El Sol with Dash services). For Dash, the Boyle Heights/East Los Angeles route had the highest service potential, followed by the El Sereno/City Terrance route (see Figure 13).

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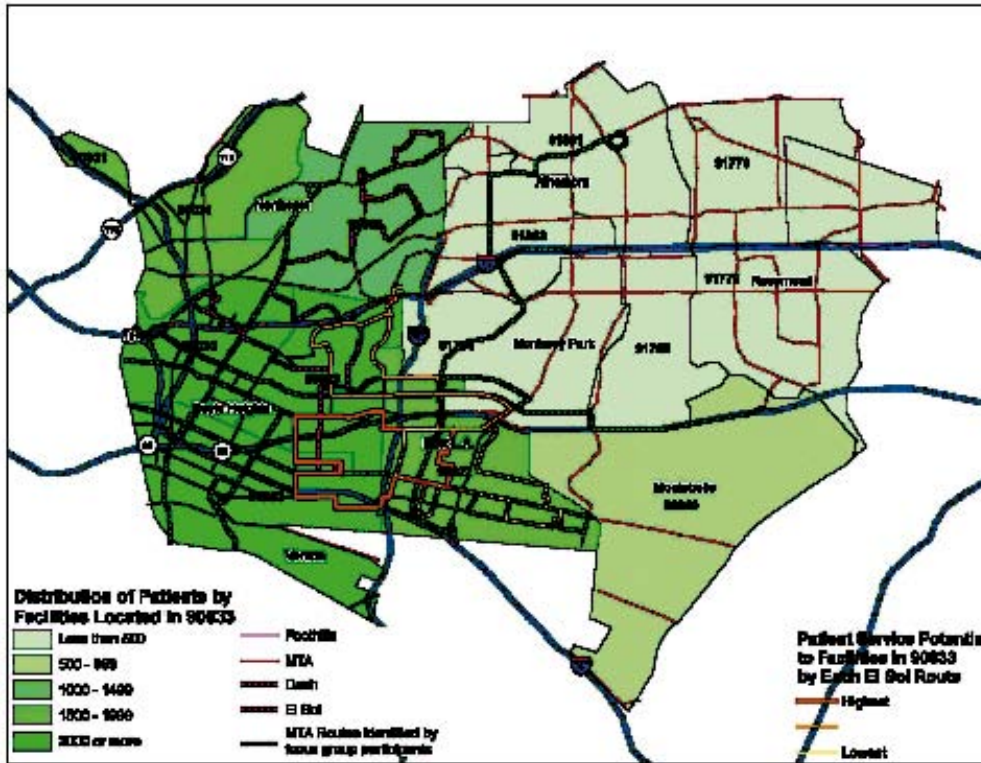


Figure 12.
Patient Service Potential to Healthcare Facilities in 90033 by El Sol Routes

Source: Patient Discharge Data, State of California Office of Statewide Health Planning and Development (OSHPD; 2006). Processed by the Author.

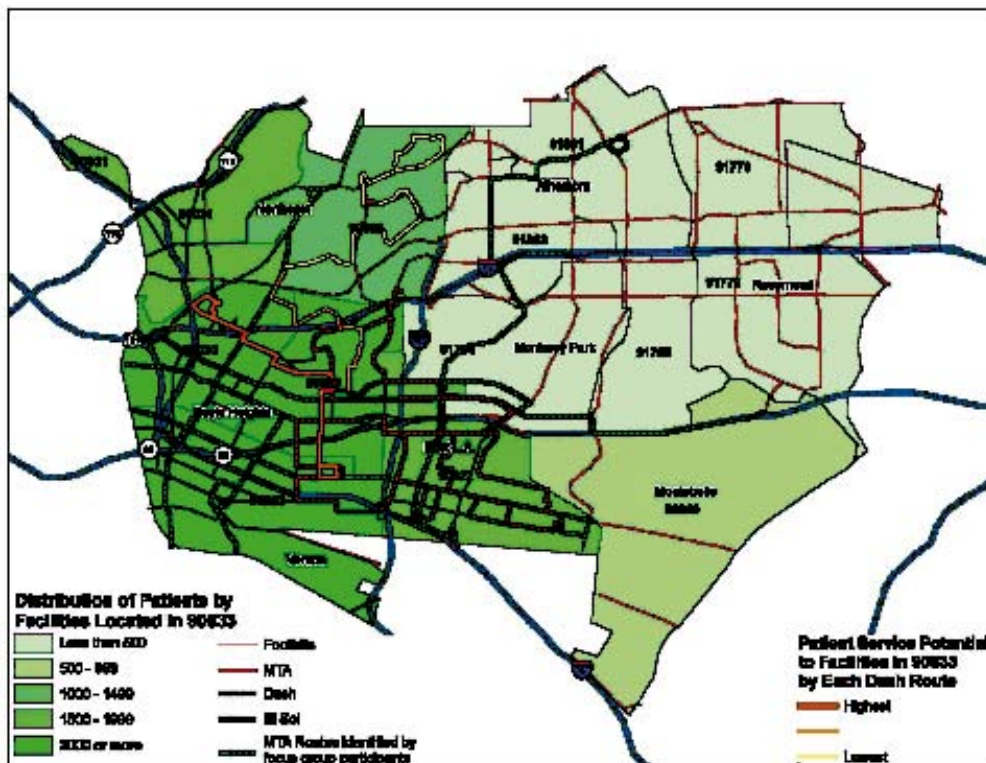


Figure 13.
Patient Service Potential to Healthcare Facilities in 90033 by Dash Routes

Source: Patient Discharge Data, State of California Office of Statewide Health Planning and Development (OSHPD; 2006). Processed by the Author.

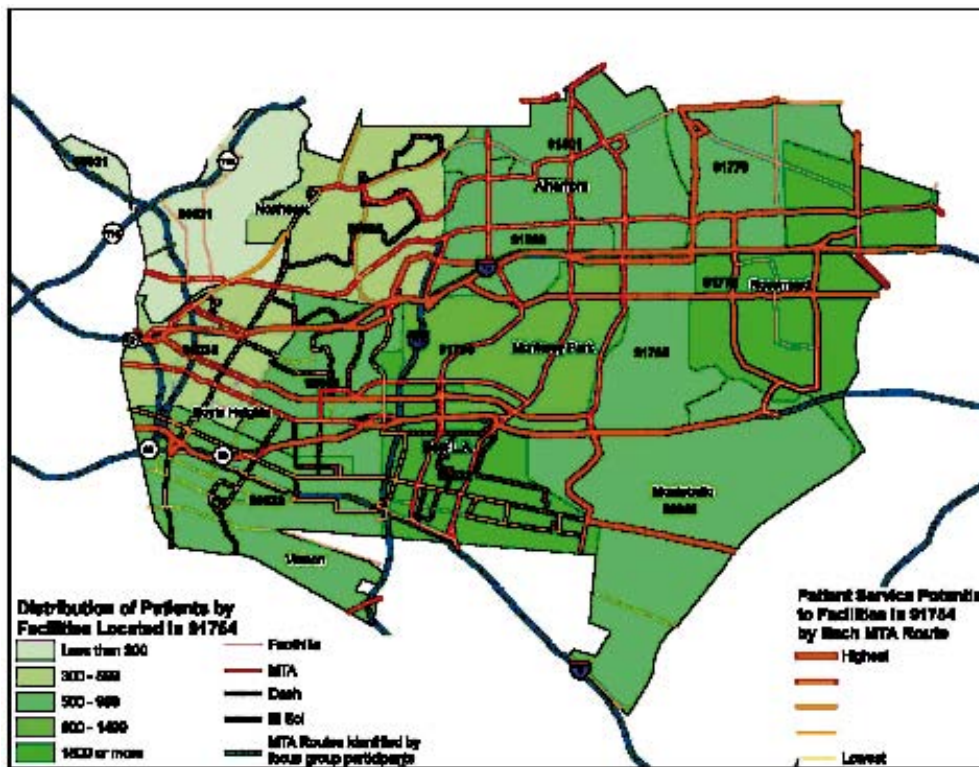


Figure 14.
Patient Service Potential to Healthcare Facilities in 91754 by MTA Routes

Source: Patient Discharge Data, State of California Office of Statewide Health Planning and Development (OSHPD; 2006). Processed by the Author.

It is interesting that while the estimated potential service to all patients in the target area identified MTA as having the highest potential share (which is understandable because of the length and the coverage of MTA’s multiple bus routes), followed by El Sol and Dash, when only the facilities in ZIP code 90033 are concerned, Dash exceeds El Sol in service potential. Furthermore, Dash provides multiple advantages, including direct connections to 90033, longer north-south routes, and connections to other public transportation services. This makes Dash particularly useful as a public transportation system for accessing health facilities in 90033, especially to the residents on the west side, where the majority of patients using these facilities live.

ZIP code 91754 has the second largest concentration of service providers in the area, serving 11,133 patients who reside in one of the 13 targeted ZIP codes. While the neighboring ZIP codes of 90022 (East Los Angeles) and 91770 (Rosemead) provide the largest number of patients,

facilities located in 91754 seem to attract patients from a wider geographic area within the targeted region. This poses a partial problem for solving the public transportation needs of patients who need to reach these facilities. However, as the service potential analysis for this ZIP code suggests (Figures 14–16), since over 43% of the patients live in ZIP codes 90022, 91770, and 91754, a localized public transportation system for 90022 and 91754, and a more regional provider for 91770, could potentially meet the demand. As Figure 14 illustrates, a number of east-west MTA routes that cross the target area have the highest service potential for achieving the regional access goals. Among them, route 70 is a strong contender. Along with others, such as route 170 (which was replaced by the extension of 287) and routes 487, 489, and 490, these services need to be combined with north-south traversing routes such as 258 and 259 to adequately reach various locations within ZIP code 91754.

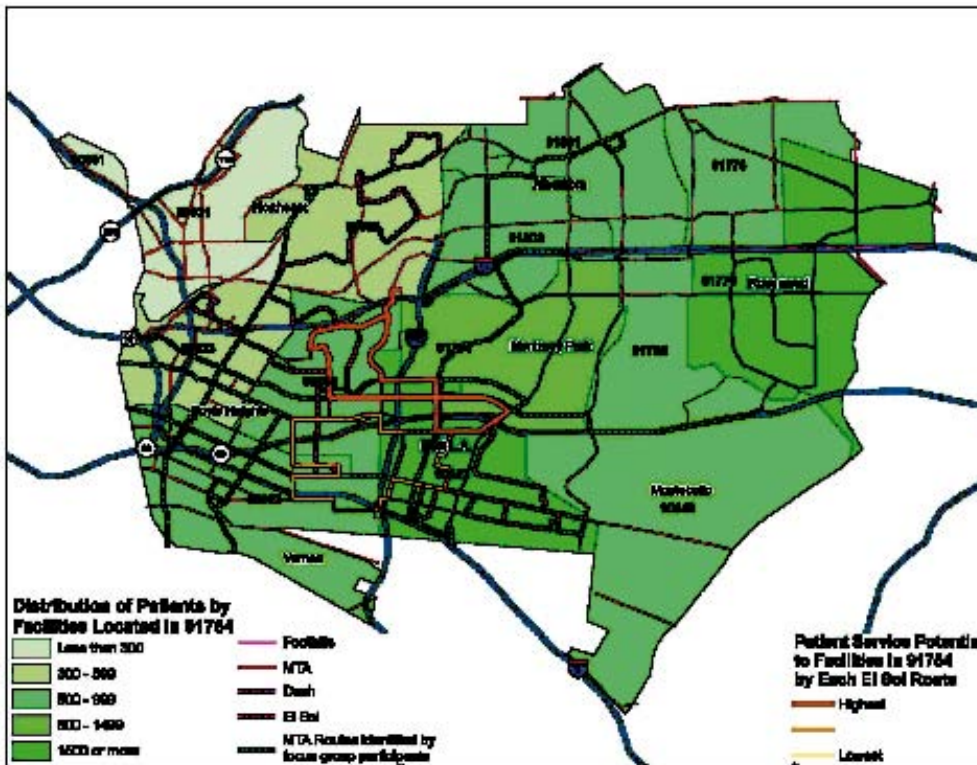


Figure 15.
Patient Service Potential to Healthcare Facilities in 91754 by El Sol Routes

Source: Patient Discharge Data, State of California Office of Statewide Health Planning and Development (OSHPD; 2006). Processed by the Author.

For localized access, especially from East Los Angeles (ZIP code 90022), El Sol and Dash appear to be more crucial. As Figure 15 illustrates, the El Sol City Terrace/ELAC route (the one serving furthest north) could be combined with MTA routes to reach various sections of ZIP code 91754. As such, this route has the highest service potential among El Sol routes. For Dash (see Figure 16), the highest potential is once again for the Boyle Heights/East Los Angeles route, which, in combination with El Sol and MTA services, could provide residents in the western section of the target area with the possibility of reaching selected facilities in ZIP code 91754.

As expected, among the three providers, MTA has the highest potential share. El Sol, which runs closer to 91754, exceeds Dash in its patient service potential. Analysis of the two major ZIP codes for the concentration of healthcare facilities used by the target area residents suggests that while regional public transportation sys-

tems are crucial for providing access to distant service providers (as was the case for many participants in the focus group meetings who go outside East Los Angeles and the West San Gabriel Valley for their healthcare needs), local transit services have the potential to provide more targeted connectivity at lower prices. The most important issue for both types of providers, however, is whether their service routes run close to the exact locations of providers and whether their bus stops are within a walkable distance of these healthcare service locations. As the focus group meeting participants suggested, the latter issue may be a challenge for some patients. In order to provide a glimpse into the issue of proximity to the actual location of service providers, our next set of analyses used addresses for healthcare facilities (from the OSHPD dataset) and physicians/surgeons (from the AMI database) for a closer examination of transit routes in the targeted area.

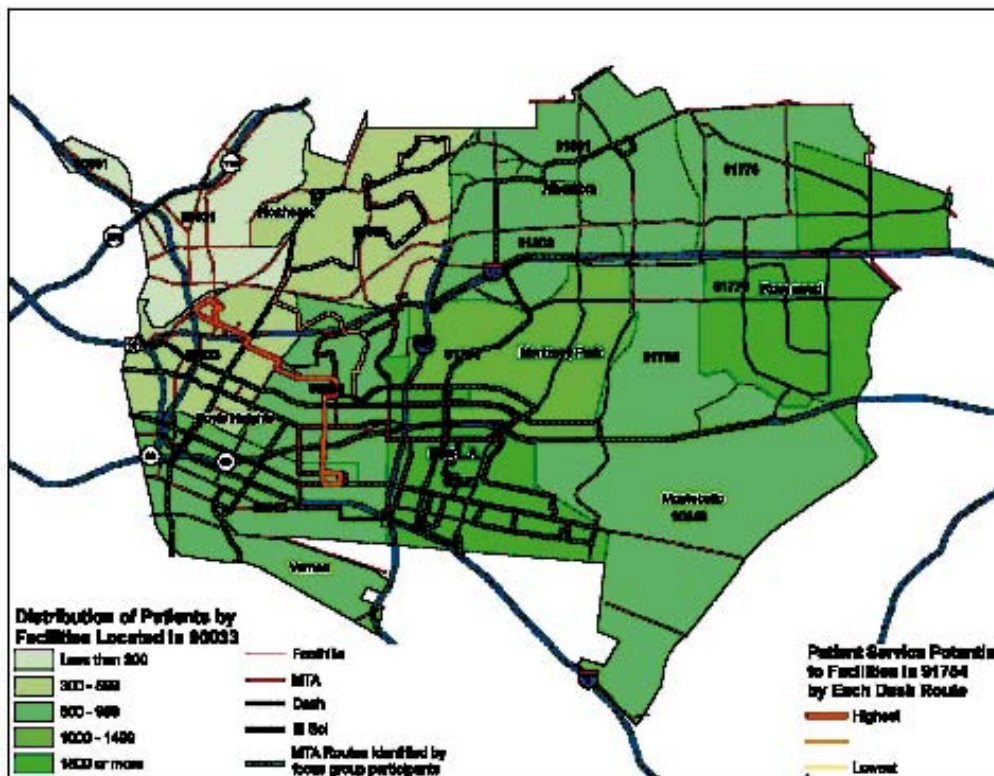


Figure 16.
**Patient Service Potential to
 Healthcare Facilities in 91754
 by Dash Routes**

Source: Patient Discharge Data, State of California Office of Statewide Health Planning and Development (OSHPD; 2006). Processed by the Author.

As Figure 17 illustrates, all OSHPD facilities and a majority of physicians and surgeons seem to be located within close proximity of some public transportation route. Even though a number of healthcare providers in Montebello do not appear to be served by MTA, Dash, and El Sol, this city has its own public transit service, which has not been included in this analysis. In fact, a number of focus group participants indicated their satisfaction with this local service when they need to use it. However, they also indicated their dissatisfaction with the length of time it takes to get to any healthcare facility. Furthermore, they found the crowded nature of major buses, their cost, and their occasional lack of timeliness problematic. This means that despite the geographic appearance that all healthcare facility locations are served by one or more transit routes, for many residents, especially the low-income population in the western section of the target area, travelling from home to any one of these facilities requires dealing with

multiple buses and service providers, whose stops and schedules are rarely coordinated.

This problem appears to be exacerbated when specific illnesses are considered. To underscore this point, we focused once again on illnesses associated with children. Figure 18 illustrates a spatial mismatch between the incidences of “neonates with significant problems” and the location of pediatricians in the target area. While it is obvious that MTA, Dash, and El Sol can provide access to many pediatricians, reaching any of these facilities requires a complex navigation of multiple routes, transit providers, or both. For example, for those who live in East Los Angeles, accessing any of the pediatricians requires either traveling to Montebello on El Sol and/or MTA or using El Sol, Dash, and/or MTA to reach a few offices in 90022, 90033, and 90063. Reaching ZIP code 90033, where a larger number of pediatricians practice, requires a long trip from 90022.

A CASE STUDY OF EAST LOS ANGELES AND THE WEST SAN GABRIEL VALLEY

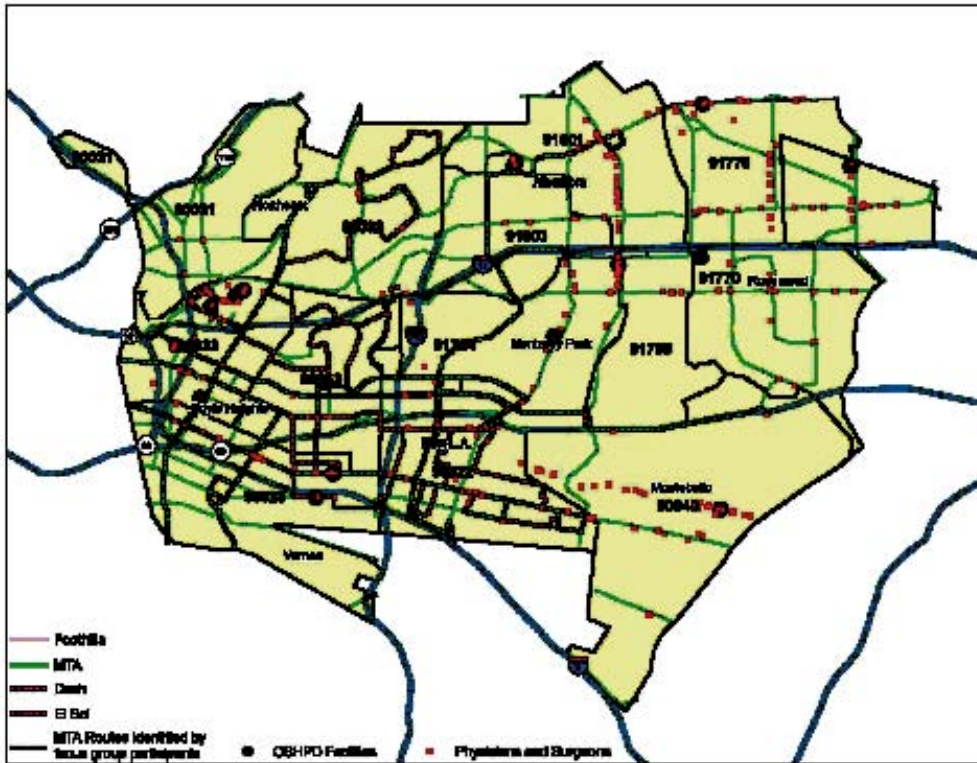


Figure 17.
OSHPD Facilities, Doctors, and Surgeons in the Target Area

Sources: American Medical Information, Info USA (200); Patient Discharge Data, State of California Office of Statewide Health Planning and Development (OSHPD; 2006). Processed by the Author.

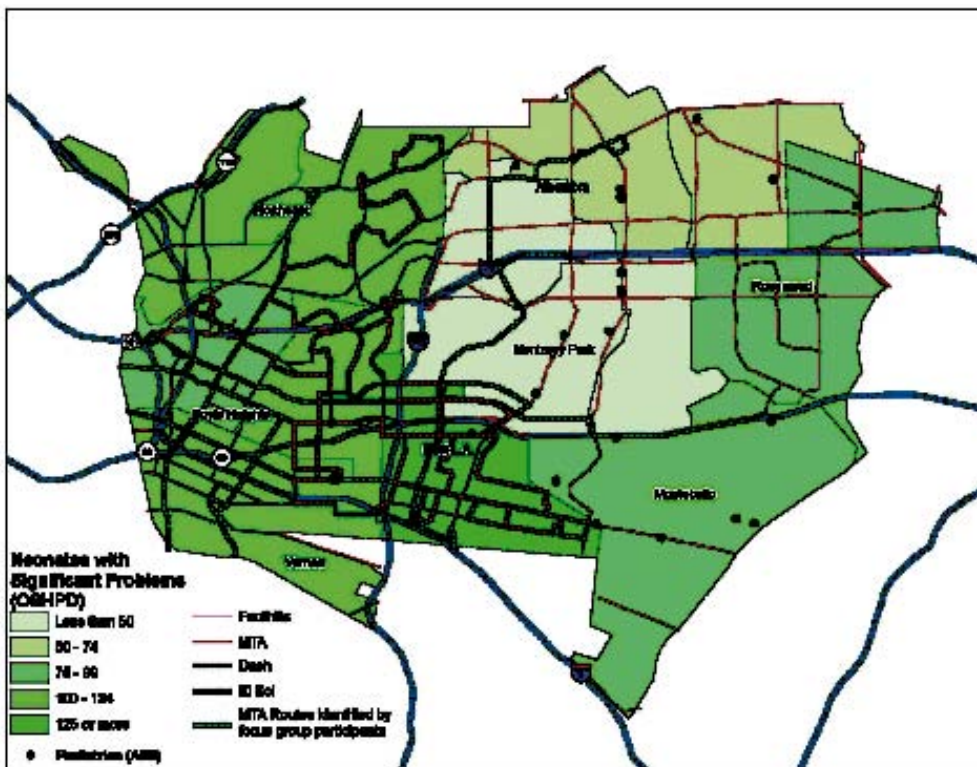


Figure 18.
Distribution of Neonates with Significant Problems and the Location of Pediatricians

Sources: American Medical Information, Info USA, 2008. Patient Discharge Data, State of California Office of Statewide Health Planning and Development (OSHPD; 2006). Processed by the Author.

PUBLIC TRANSPORTATION AND ACCESS TO HEALTHCARE

It is clear from this detailed analysis that, in its existing form, public transportation is not fully capable of creating an ideal connection between patients and relevant healthcare facilities. However, a targeted approach for creating healthcare-friendly public transportation is possible and should include the following considerations:

1. routes with the greatest potential for connection to existing healthcare facilities should be designated as healthcare transit corridors,
2. scheduling, stops, and drop-offs among various routes should be coordinated within and across transit service providers, and
3. particular modifications of existing transit routes and the design of new ones should create optimal connections between patients and major healthcare locations.

In our target area, connection to ZIP codes 90033 and 91754 demands such attention.

To illustrate how such routes might be selected, we ran a final analysis. After creating a quarter-mile buffer (typical walkable distance) around all MTA routes, these areas were spatially joined with OSHPD facilities, physicians, and surgeons. This methodology allowed us to assign to each route the total number of locations it served. Among MTA routes, 620, 78, 251, 255, 487, and 489 served three or more OSHPD facilities. Routes 620, 78, 70, 255, 605, 251, 71, 250, and 79 reached over 700 physicians and surgeons. Clearly, 620, 70, and 255 are the most significant routes for connecting to healthcare providers. While route 70 runs from east to west, in the middle of the target area, routes 620 and 255 cover the western section in a loop and in a north-south direction (which serves the Northeast communities, as well as those in Boyle Heights and East LA). A complete coordination between these MTA routes with El Sol and Dash services could significantly improve transportation-related access to health services in the low-income communities in the western section of the targeted areas. This may require

the designation of these MTA routes as health service corridors and full consideration of new Dash and MTA routes in the future that will expand services to ZIP code 90033.

In addition to solving the issue of reaching ZIP codes 90033 and 91754, time and distance remain a problem. As in the case of route 720, which provides rapid connections across the southern section of the target area and into the Wilshire corridor, additional rapid transit systems may be necessary for the area. In fact, a route paralleling routes 70 or 76 may be useful for the purpose of reaching various medical facilities.

For the purpose of connectivity, it is important for us to reflect on those routes our focus group participants found useful (18, 30, 60, 68, 251, 254, 605, and 720). These routes form a grid that make movement between north, south, east, and west possible. In fact, El Sol and, to some extent Dash, form smaller grids as well. Local usage of public transit appears to be a function of area coverage and connectivity. Therefore, creating a transit service design which focuses on getting residents to health service providers (as opposed to places of work) needs to consider the location of these services, as we did. This would suggest that in addition to those discussed previously, route 262 may also be a good candidate as a healthcare corridor transit service for facilities in ZIP Code 91754.

Based on the foregoing analyses, our study identified four existing transit routes (i.e., 70, 255, 262, and 620) that could potentially deliver the highest number of patients to hospitals, clinics, and medical offices (see Figure 19). These routes could be designated as healthcare transit corridors, improving healthcare access for patients in East Los Angeles and West San Gabriel Valley.

While designing, modifying, extending, or dedicating particular public transportation routes may answer the question of connectivity, the issues of time and price must be solved separately. As mentioned earlier, having one or more rapid transit systems with stops near major healthcare providers (or places with a large number of

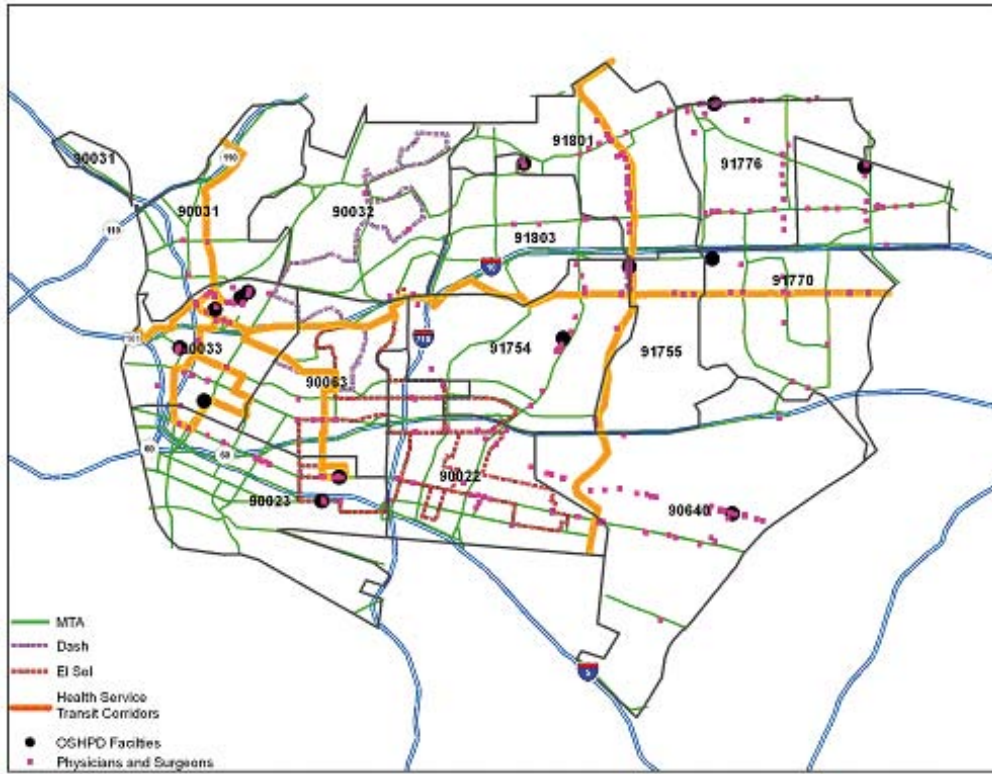


Figure 19.
Proposed Healthcare Transit
Corridors for East Los Angeles
and West San Gabriel

doctors) may reduce patients’ travel time; however, it does not resolve the issue of cost – one of the reasons our focus group participants used El Sol or Dash. It may be beneficial to create a particular pricing tier for those who use the transit system to reach health service facilities. This could be accomplished through a two-step process. First, specific MTA routes would have to be identified as health corridors/routes. Second, lower prices could be assigned to nonpeak hour trips within these corridors. This would potentially solve two problems simultaneously. First, the transportation cost for lower socioeconomic groups would be reduced. Second, the problem of crowded buses during rush hours (identified by our focus group participants) would be partially avoided.

CONCLUDING REMARKS

This research provided a glimpse into the health conditions and access to healthcare in 13 ZIP codes that encom-

pass East Los Angeles and West San Gabriel communities. The issues of inadequate medical services and the spatial mismatch between demand and supply for particular health challenges, such as prenatal and neonatal problems, illustrated the inequitable geography of health and access to healthcare in this subregion of Los Angeles County. This inadequacy compounds the problems associated with lack of access to health insurance and creates obstacles to improving the overall health of communities, especially those with high concentrations of lower socioeconomic groups and minorities. An indication of this situation is the high rate of reported hospitalization for issues such as neonates with significant problems or diabetes. Lack of adequate services to treat and prevent these problems may create higher rates of hospitalization after symptoms have worsened.

It is in this vein that this study attempts to bring attention to one aspect of access to healthcare: urban transportation. Our findings, which include qualitative

information from focus group meetings with community members (as well as a workshop with health advocates, health professionals, and various representatives from public agencies, the philanthropic community, and health insurance providers) and quantitative analyses of MTA, El Sol, and Dash services in the target area, allow us to offer a conceptual framework for creating healthcare-friendly public transportation. This includes identifying potential healthcare transportation corridors, based mostly on adapting existing transit services, that could allow a significant majority of patients to reach their medical service providers (including doctors' offices). We expect that such an approach would serve the target area well, particularly the western section, which includes Boyle Heights and East Los Angeles.

Through this research, we have identified two ZIP codes where a majority of patients receive their healthcare needs. We have also identified specific corridors that are served by a large number of physicians/surgeons and where particular transit services (i.e., routes) operate. We hope that our case study will expand research, and ultimately, planning efforts that will expand the connection between public transportation and access to healthcare. Improving public transportation services would directly benefit the health outcome of a given community by allowing residents to visit their doctors more frequently and decreasing the demand for emergency and more complicated treatment in the future. The relationship between the availability of public transportation and the health and well-being of a community is a lesson reinforced in many urban and rural settings. With appropriate public transportation planning intervention, the problems observed in the Antelope Valley and other localities discussed earlier would more likely be avoided in the future, especially in low-income areas such as the western section of our target area.

REFERENCES

- Balfour, J. L., & Kaplan, G. A. (2002). Neighborhood environment and loss of physical function in older adults: Evidence from the Alameda County Study. *American Journal of Epidemiology*, 155(6), 507-515.
- Ball, J., & Fisher, P. F. (1994). Visualizing stochastic catchments in geographical networks. *The Cartographic Journal*, 31, 27-32.
- Boyle, P. J., Kudac, H., & Williams, A. J. (1996). Geographical variation in the referral of patients with chronic end stage renal failure for renal replacement therapy. *Quarterly Journal of Medicine*, 89, 151-157.
- Buki, L. P., Borrayo, E. A., Feigal, B. M., & Carrillo, I. Y. (2004). Are all Latinas the same? Perceived breast cancer screening barriers and facilitative conditions. *Psychology of Women Quarterly*, 28, 400-411.
- California Health Interview Survey (CHIS). (2008, December). *CHIS 2007 Adult Survey*. UCLA Center for Health Policy Research.
- Davenport, D., & Harding, C. (2004). Infant mortality among African Americans in Antelope Valley. Retrieved August 8, 2009, at: <http://www.lapublichealth.org/spa1/docs/infantmort.pdf>
- Fitzpatrick, A. L., Powe, N. R., Cooper, L. S., Ives, D., & Robbins, J. A. (2004, October). Barriers to health care access among the elderly and who perceives them. *American Journal of Public Health*, 94(10), 1788-1794.
- Flores, G., Abreu, M., Olivar, M. A., & Kastner, B. (1998). Access barriers to health care for Latino children. *Arch Pediatr Adolesc Med.*, 152, 1119-1125.
- Gatrell, A. C., & Senior, M. L. (1999). Health and health care applications. In Longley, P. A., Goodchild, M. F., Maguire, D. J., & Rhind, D. W. (Eds.), *Geographical Information Systems: Management Issues and Applications*, 2nd Edition, Vol. 2 (pp. 925-938). New York: Wiley.

- Hubbell, A. P. (2006). Mexican-American women in a rural area and barriers to their ability to enact protective behaviors against breast cancer. *Health Communication, 20*(1), 35–44.
- Hull, A. (2005). Integrated transport planning in the UK: From concept to reality. *Journal of Transport Geography, 13*, 318–328.
- Jones, A. P., & Bentham, G. (1998). Accessibility and health service utilization for asthma in Norfolk. *England Journal of Public Health Medicine, 20*, 312–317.
- Joseph, A. E., & Phillips, D. R. (1984). Accessibility and utilization: *Geographical perspectives on health care delivery*. New York: Harper & Row.
- King, D. W., Snipes, S. A., Herrera, A. P., & Jones, L. A. (2009). Health and healthcare perspectives of African American residents of an unincorporated community: A qualitative assessment. *Health & Place, 15*, 420–428.
- Kipke, M. D., Iverson, E., Moore, D., Booker, C., Ruelas, V., Peters, A. L., & Kaufman, F. (2007). Food and park environments: Neighborhood-level risks for childhood obesity in East Los Angeles. *Journal of Adolescent Health, 40*(4), 325–333.
- Love, D., & Lindquist, P. (1995). The geographical accessibility of hospitals to the aged: A geographic information systems analysis within Illinois. *Health Services Research, 29*, 627–651.
- Lovett, A., Haynes, R., Sunnenberg, G., & Gale, S. (2000). *Accessibility of primary health care services in East Anglia* [HPP Research Report Series 9]. Norwich: School of Health Policy and Practice, University of East Anglia.
- Martin, D., Roderick, P., Diamond, I., Clements, S., & Stone, N. (1998). Geographical aspects of the uptake of renal replacement therapy in England. *International Journal of Population Geography, 4*, 227–242.
- Martin, D., Wrigley, H., Barnett, S., & Roderick, P. (2002). Increasing the sophistication of access measurement in a rural healthcare study. *Health & Place, 8*, 3–13.
- Parker, E. B., & Campbell, J. L. (1998). Measuring access to primary medical care: Some examples of the use of geographical information systems. *Health & Place, 4*, 183–193.
- Spiekermann, K., & Wegener, M. (2000). Freedom from the tyranny of zones: Towards new GIS-based spatial models. In Fotheringham, A. S. & M. Wegener (Eds.), *Spatial Models and GIS: New Potential and New Models* (pp. 45–61). London: Taylor & Francis, London.
- Sallis, J. F., Frank, L. D., Saelens, B. E., & Kraft, M. K. (2004). Active transportation and physical activity: Opportunities for collaboration on transportation and public health research. *Transportation Research Part A, 38*, 249–268.
- Strover, S., Chapman, G., & Waters, J. (2004). Beyond community networking and CTCs: Access, development, and public policy. *Telecommunications Policy, 28*, 465–485.
- Walter, C., Althouse, R., Humble, H., Leys, M. J., & Odom, J. V. (2004, April). West Virginia survey of visual health: Low vision and barriers to access. *Visual Impairment Research, 6*(1), 53–71.
- Wolf, R. (2007, May 3). Millions of kids lack coverage. *USA Today*, P6A.
- Yang, S., Tipnis, S, Saenz, C, & Kelly, N. (2004). *The impact of an intervention promoting mass transit use on access to a medical home for low-income, minority urban children*. Abstr AcademyHealth Meet. 2004, 21 [Abstract no. 1633]. Retrieved August 8, 2009, at: <http://gateway.nlm.nih.gov/MeetingAbstracts/ma?f=103624667.html>