Using GIS to Determine a Spatial Measurement of Effective Service Areas of Human Services for the Minnesota Family Investment Program Facilities in Saint Paul, MN

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Abstract

This research examines processes of locating new Minnesota Family Investment Program facilities in Saint Paul, Minnesota. The goal was to site facilities where the greatest need exists based on an analysis of demographic and geographic characteristics. Locations of the facilities were determined by identifying areas with the closest proximity to areas of high demand and near major roadways. Demographic variables examined included: a) ethnicities with the highest total recorded cases in the Minnesota Family Investment Program (MFIP), b) ethnicities with the highest number of total cases in the MFIP program for 59 months or more, c) and ethnicities with the highest number of children in the MFIP program. Potential locations for new facilities were determined by applying the following constraints. Each facility must be location in an area: a) within an area of high concentration of demand, b) within a location of a current school or library, c) within ½ mile of a major roadway. Point density maps were produced through use of Geographic Information Systems (GIS) to show findings.

Introduction

Finding a new fixed location that best serves the demands of a region is difficult when working with population data. All populations are dynamic (Gorr, Johnson, and Roehrig, 2001) which indicates the demand of a population can change throughout a region. Standards for analysis cannot be set for all study areas (Matisziw and Murray, 2001) and this must be considered when reviewing and examining data. Each study area, and the variety of characteristics within each area, should ultimately influence the type of demand or need that will be placed on a facility. Standards of service should be based on the demand and characteristics of the area the facility will serve (Bird and Haulin, 1995). In terms of demographics, each area is also different. According to Gordon, Hadsall, and Schommer (2005), demographics influence and change the needs of clients. This research attempts to combine location and demographic variables associated with client data in order to determine areas of high demand. Bird and Haulin (1995) posed a question, “should access be judged on the basis of the patient’s perspective rather than arbitrary distance factors?” Although geographic and transportation factors are key elements in reviewing accessibility, demographics and the type of demand in the region should play the major role in determining the placement of a new facility. The definition of effective service is the

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"extent to which client population needs are met" (Gorr *et al.*, 2001). For a facility to be effective, it needs to be in a location that serves the needs of the surrounding population.

Transportation also plays an important role in the placement of facilities. Lack of transportation will inevitably hinder facility access (Horton and Johnson, 2010). GIS is a valuable resource when analyzing population and transportation data. "GIS allows the study to analyze transportation and facilities" (Miwa, Kawaguchi, Arima, and Kawahara, 2006). This software serves as a bridge between the geographic elements of an area and the demands of the clients in the same region. Geographic access is a possible indicator (Bird and Haulin, 1995) of success and especially so if surrounding transportation promotes easy access to a new facility.

Background

The Minnesota Family Investment Program (MFIP) has facilities located throughout Saint Paul, Minnesota. MFIP and is designed for "low income families with children" who require economic assistance (Department of Human Services Online, 2014). Each center offers a wide range of services that are geared towards improving the quality life for individuals. According to Kate Probert, MFIP/DWP Employment Services Division Manager (2014), all MFIP locations focus on helping clients obtain employment and education services, support for job searches, and engagement for overall family stability. These services are available to families until they are 130% above the federal poverty level. Additionally, client participation is limited to 60 months, unless there are extenuating circumstances suggesting an extension is appropriate.

Purpose

This study explores a method of siting new MFIP facilities based on the needs of the area and transportation access. This project uses current case data, information on the placement of current facilities, and information on the proximity of main roadways (highways and interstates).

Although it is not required for an MFIP location to be in a school or library, for the scope of the analysis, this project focuses on placing a new facility in one of these buildings. Locations that meet these criteria will be considered as new potential MFIP facility locations.

Study Area and Major Roadways

The study area is the City of Saint Paul, Minnesota, located in the southern portion of Ramsey County. Saint Paul has the highest concentration of cases in Ramsey County and is the current focus for the placement of new MFIP facilities. For this project, cases that fell outside of the study area were excluded from the analysis.

Interstates roads and highways were selected inside the study area to represent major roadways in the project area. Research provided by Ramsey County (2014) suggests that 80% of the clients in the MFIP program travel by car instead of public transportation. Major roadways for this study were Highway 280, Interstate 94, Interstate 35E, and Highway 52.

Projection

All shapefiles were projected in the NAD_1983_86_Adj_MN_Ramsey_Feet projection.

Methods

Procedure

Data was provided by Ramsey County and

analyzed in ArcGIS 10.1 and 10.2. ArcGIS was used to identify relationships in the data and to visually display the result.

Ethnicity and Areas of Demand

Placement of MFIP facilities is based on the demand in the study region. "Demand is considered served or covered when it falls within some prescribed service standard (time or distance) of a site facility" (Matisziw and Murray, 2001). The data included demographic and case information associated with each client in the MFIP program. Multiple attribute tables were joined together using a Personal Master Index (PMI) number to create a master attribute table. These tables contained XY coordinate data which were used to generate a point file associated with each MFIP case.

Attributes were selected from the data by ethnicity. Providing effective and culturally sensitive services is a goal of the MFIP program and Ramsey County (Karcz, 2014). The ethnic groups used for the study were as follows:

1. African American
2. American Indian
3. Asian American
4. Hmong
5. Latino/Hispanic
6. Other Asian Immigrant
7. Other Black Immigrant
8. Somali
9. Missing/Other
10. White/Caucasian

To isolate regions of Saint Paul that contain high concentrations of cases, three elements of the case data were analyzed. Areas with high concentrations of cases were determined by looking at ethnicities with the highest number of total recorded cases, ethnicities with the greatest number of cases that have been in the MFIP program for over 59 months, and the ethnicities that have the greatest number of total children in the program.

The variables selected were based on ethnic groups that have a higher potential demand for MFIP resources. "People requiring more services stay close to home" (Matisziw and Murray, 2001), which suggests concentrated areas of cases could mean a higher demand on MFIP services. Variables were parsed for study in the following manner:

1. African American, Other Asian Immigrant, and White/Caucasian ethnicities that had the greatest number of cases in the program (Table 1). African American accounted for 3222 cases, Other Asian American for 1152, and White/Caucasian for 1508 cases. These three groups accounted for 66% of the total number of 8858 cases.

Table 1. Total number of cases recorded in the study area.

Ethnicity	Total Number of Cases
African American	3222
American Indian	213
Asian American	429
Hmong	728
Latino/Hispanic	629
Multi-Racial	183
Other Asian Immigrant	1152
Other Black Immigrant	321
Somali	470
White/Caucasian	1508
Missing/Other	3
Total	8,858

2. African American, Hmong, and White/Caucasian groups had the highest number of cases that were over 59 months in the MFIP

program. Table 2 shows the total number of these cases per ethnicity. African American had the highest total with 859 cases, Hmong had 170 cases and White/Caucasian had 329 cases. Together, these ethnicities accounted for 82% of the 1652 cases over 59 months in time.

Table 2. Total number of cases over 59 months in the MFIP program by ethnicity. The maximum number of months for cases in the MFIP program without special circumstances is 60 months.

Ethnicity	Total Number of Cases Over 59 Months in the MFIP Program
African American	859
American Indian	62
Asian American	11
Hmong	170
Latino/Hispanic	99
Multi-Racial	28
Other Asian Immigrant	23
Other Black Immigrant	17
Somali	54
White/Caucasian	329
Missing/Other	NA
Total	1,652

3. African American, Hmong, Other Asian Immigrant, and White/Caucasian had the highest number of children in the program. African American clients had 6424 children, Hmong had 2447, Other Asian Immigrant had 3021, and White/Caucasian had 2682. Table 3 shows that this totals to be 73% of children in the program. These four groups were used in this portion of the analysis because there was a significant break between these groups and the rest of the ethnicities in the study (Table 3). After isolating variables in Tables 1-3, separate point density displays of each were created.

Table 3. The total number of children in the MFIP program by ethnicity.

Ethnicity	Total Number of Children by Ethnicity
African American	6424
American Indian	443
Asian American	995
Hmong	2447
Latino/Hispanic	1284
Multi-Racial	486
Other Asian Immigrant	3021
Other Black Immigrant	653
Somali	1527
White/Caucasian	6282
Missing/Other	NA
Total	19,962

Density values displayed the number of points located within a particular region. The density layers were aggregated to produce an overall density map of all three variables. In Figure 1, dark red areas represent concentrations of demographics from Tables 1-3 occurring most frequently suggesting areas of a higher service demands. Areas highlighted in Figure 1 were used as a focal point of the location and transportation analysis.

Facility and Transportation Accessibility

Since new facilities need to be located in areas that were accessible, a select was performed to find libraries or schools within a 1/2 mile of a major roadway as MFIP program facilities are frequently located within a school or library in the region. A 1/2 mile buffer was then created around the selected schools and libraries to show the

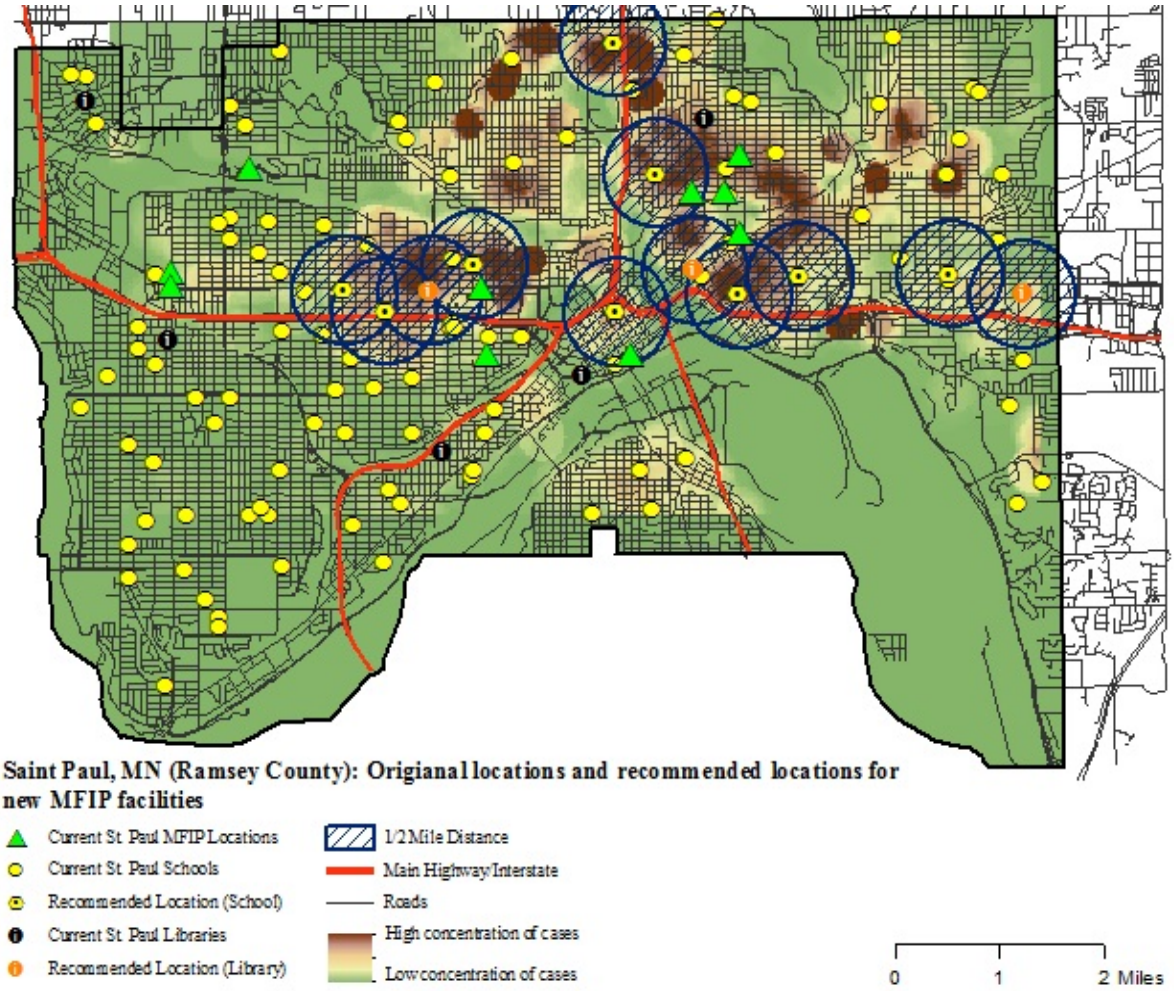

Figure 1. The dark red areas indicate higher densities of MFIP cases while blue zones represent the 1/2 mile distance from a school or library to a major road.

relationship between the school/library locations, nearby roadways, and the concentrated areas of cases. Once a new layer of potential locations was created, it was compared to the density map. In Figure 1, recommended schools and libraries for new MFIP locations are displayed in relation to areas of high case concentrations and the transportation parameters that were used in the analysis.

Results

Results of the study show areas with high concentrations of cases in the middle and northern portion of the study area; higher concentrations also extend to the eastern side. The schools and libraries chosen were located primarily in regions within 1/2 mile of a major roadway. The study suggests that new MFIP facilities in these areas might promote easier access for individuals who are located in areas of higher demand.

Twelve locations were identified as new potential MFIP locations. Recommended facilities were based on the geographic location, transportation, and the demand in the area. The density of cases in the study area suggest a higher level of demand (Figure 2). As seen in

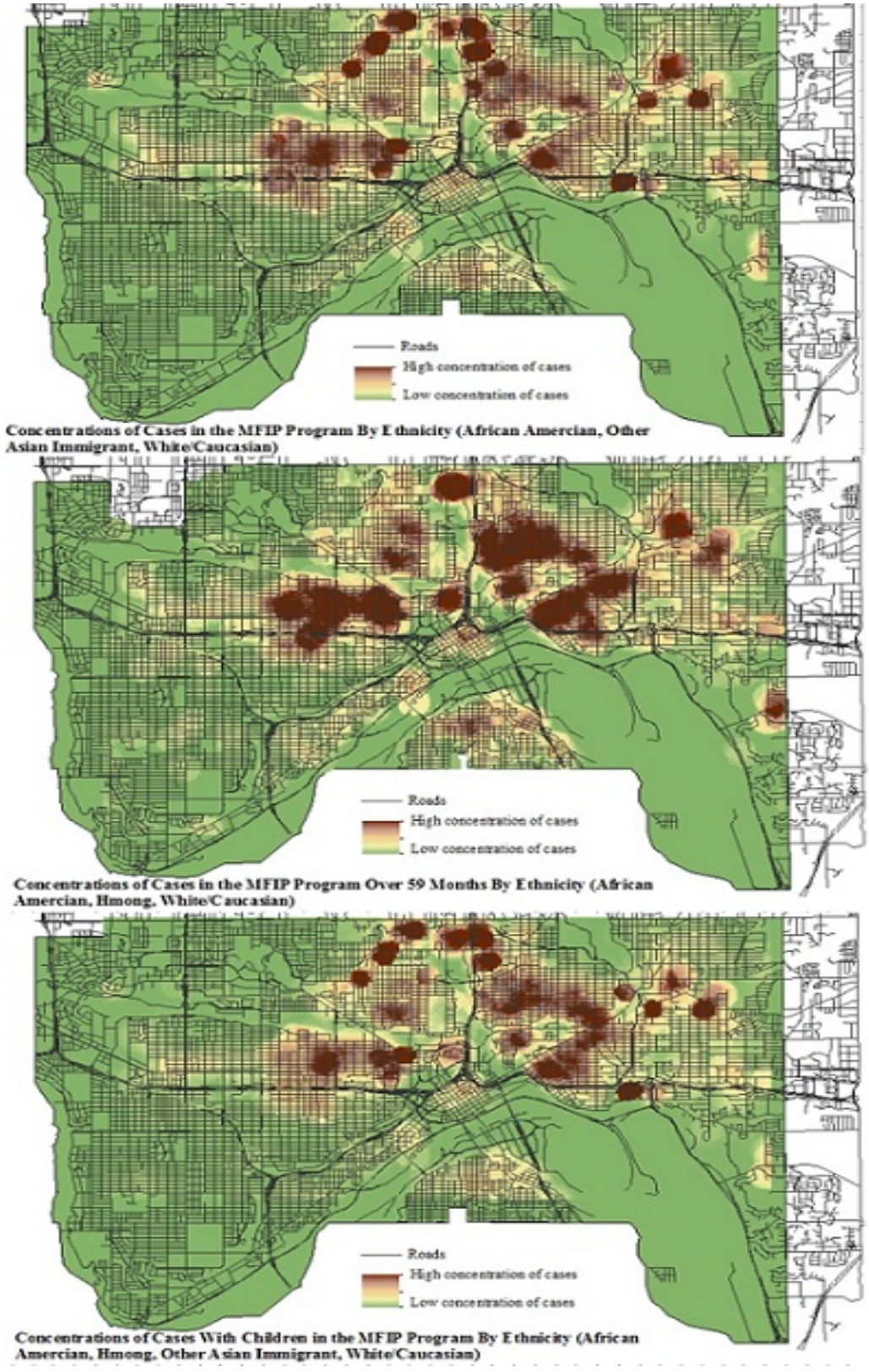

Figure 2. Concentrations of cases based on point density. The dark red areas of the map show high concentrations of case densities.

Figure 1, spatial relationships provide a comparison of the recommended facilities in relation to current MFIP locations, libraries, and schools. Three libraries and nine schools were identified as new potential locations. Table 4 provides a list of these libraries and schools.

Table 4. Locations of libraries and schools recommended for new MFIP locations.

Libraries	Schools
Dayton's Bluff Library	Dayton's Bluff Elementary
Sun Ray Library	American Indian Magnet
Rondo Community Outreach	Nokomis Montessori South
	Mississippi Creative Arts Magnet
	Bruce F Vento Elementary
	Area Learning Center
	Jackson Preparatory
	Maxfield Elementary
	Hubbs Lifelong Learning Center

Ethnicity and Population Trends

This study suggests ethnicity plays a major role in the MFIP program and high concentrations of ethnic groups in the program should influence the location of new facilities. Greater numbers of cases occur in locations where ethnic groups participate in the programs (Figure 2). As the population increases, this could mean the population of the ethnic groups in the program will increase as well. At present, African American, Other Asian American, and White/Caucasian groups alone account for over half (66%) of the 8858 cases.

When evaluating cases, there is a dramatic increase between the number of cases and the number of children associated with cases enrolled in the program. With just the cases used in the study, 19,962 children were recorded as connected to parents in the MFIP program. African Americans, Other Asian Immigrant, and White/Caucasian groups accounted for 73% of the children recorded in the program.

In the overall 8858 case count in the study, 18% or 1652 of the cases were shown as over 59 months in the MFIP program. African Americans, Hmong, and White/Caucasian ethnic groups accounted for 82% of these cases.

According to the United States Census Bureau (2014), the population of Saint Paul, Minnesota showed an increase from 285,068 in 2010 to an estimated 290,770 in 2012, a 1.9% increase. Assuming the current trend continues, an estimation of the population in Saint Paul, Minnesota could reach 296,294 in 2014.

Also according to the United States Census Bureau (2014), 22.8% of the population of Saint Paul, Minnesota was recorded as below the poverty level between the years of 2008-2012. In 2012, this meant that 66,295 people fell under the classification. This estimation could rise to 67,555 in 2014 if trends in the population remain constant. Future patterns in immigration could also influence the change in population in the city. All of this suggests increasing demand on human service facilities and MFIP resources.

Discussion

Although this study provides an exploration of new locations for MFIP facilities, further study would be needed to determine exactly why and how clients

utilize services. Directly surveying clients in the program could provide valuable insight. Wan, Zou, and Sternbery (2012) suggest it is difficult to make assumptions about the demand of an area and to determine a fixed location that will effectively serve an evolving clientele. It is difficult to find exact causes influencing demand in a region and to build a facility exactly to that region's need. With the locations selected in this analysis, defining locations in high-demand areas will potentially decrease the demand of service and resources on existing MFIP facilities. Ease of transportation provides the facility with better access to the public, and in turn, offers the opportunity for clients to have better access to the facility.

With the current count of ten MFIP locations in Saint Paul, Minnesota, this would divide the 8858 cases used in the study to 885.8 cases per facility. This is under the assumption that each facility has an equal distribution of cases.

Limitations

Not all MFIP cases were mapped in this study. Any incomplete addresses in the data were not included and consequently the total cases in this study were lower than actual number the MFIP program actually serves.

Although the data used in this study are a representation of the current MFIP client base, the population in the area is constantly changing and needs are likewise changing. The analysis performed in this project could yield different results if conducted at a later date since the analysis relies primarily on client data for its design needs. It is also important to note that facilities' are impacted by budgetary or legal constraints. These constraints were not considered in the analysis.

Distance to services is an important factor when determining how far a client needs to travel and travel impedance studies should be undertaken to make better assessments of travel time for clients (Delamater, Messina, Shortridge, and Grady, 2012). Although the road files used in this project were not suitable for a networking analysis, networking analysis would be beneficial in creating a more accurate prediction of how new potential facilities are impacted by transportation in the study area.

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