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Do Magnet Schools Attract All Families Equally? A GIS Mapping Analysis of Latinos

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School choice programs in metropolitan Hartford, Connecticut have provided families with new outlets for pursuing quality education for their children. Interdistrict magnet schools, in particular, been very popular because they tout innovative programs and curriculums. Currently there are a total of 19 inter-district magnet schools in the Hartford region which were all created for the purpose of reducing racial and socio-economic isolation under the 1996 Sheff vs. O'Neill decision. Almost ten years later, these magnet schools and their collective mission has been questioned by many. The goal of this study is to examine the question: Do magnet schools attract all families equally? More specifically, given that the City of Hartford's population is over 40 percent Latino, we investigate whether Latino student application rates at interdistrict magnet schools are statistically representative of the racial characteristics of the neighborhoods in which they reside. In order to effectively answer this question, this quantitative study will draw upon magnet school application data and district enrollment data, with Geographic Information Systems (GIS) tools, to map out application patterns for one specific magnet school.

This exploratory study focuses on one interdistrict magnet -- the Montessori Magnet School (MMS) -- at both the district and the neighborhood levels. We argue that the number of MMS applicants over the past five years is not statistically representative of the demographics of the students' residences. At the school district level, application rates varied by race. Specifically, the majority of the applicants to MMS were Hispanics (33%) and Blacks (45.5%). Further, chi-square tests for goodness of fit show that Hispanics living in the city of Hartford were *less likely* to apply to MMS than one would expect.

At the census tract level (for one year only), chi-square tests for goodness of fit reveal discrepancies between census tract racial demographics and application racial demographics for Hispanic and Black students. In general there are some clusters of statistically significant application trends. Specifically, Hispanic students were *less likely* to apply if they resided in the west end of Hartford, but *more likely* to apply in small sections of the south end and north end of Hartford. In contrast, Black applicants were more likely to apply to the MMS if they resided in the south end, west end and sections of the north end of Hartford. However, one should not generalize these findings to the other 18 inter-district magnet schools in metropolitan Hartford.

Significance of the Study

In addition to exploring questions of equity regarding magnet schools, a broader purpose of this paper is to illustrate how geographic information system (GIS) analysis may be applied, at both the district-level as well as the neighborhood-level, to investigate demographic patterns in school application data. Previous research on magnet school equity has focused on broader geographic units of analysis, such as town or school district level, but this study also concentrates on smaller units of geography, such as the census tract (a proxy for neighborhoods). By focusing on smaller geographic units, a more specific and detailed understanding of demographic patterns in student applications may be achieved, allowing us to make spatial interpretations that may not ordinarily be recognized.

Local and National Debates on Magnet School Equity

Magnet schools present an interesting problem in using voluntary school choice programs to reduce racial and socio-economic inequality in schools. In regions like Hartford, magnet school administrators attempt to use marketing and lotteries to create school populations of mixed demographics in order to achieve the desegregation goals stated by the 2003 *Sheff v O'Neill* settlement. However, since the application process depends upon parental action, schools exert only partial influence over who applies, and therefore enrolls. Magnet schools are not immune to problems over racial imbalance. In the Hartford area, the Classical Magnet School enrolled 96 percent minority students in 2004; none were white students from suburban towns. Furthermore, at the Hartford Magnet Middle School that year, only 15 percent of the student population was White, and out of these, only 54 Whites resided in the suburbs (Frahm, 2004). Even more complicated is the fact that several Hartford-area magnet schools are attracting more suburban minorities than suburban whites (Frahm, 2004).

Table: Interdistrict Magnet School Enrollments, 2003-04 Source: (Frahm, 2004)

Magnet School	Minority from Hartford	White from Hartford	Minority from Suburbs	White from Suburbs	Percent Minority
Classical Magnet	422	19	9	0	96%
Pathways	74	3	4	1	95%
Hartford Magnet Middle School (LC)	366	35	142	54	85%
Sport & Medical Sciences	224	44	77	14	84%
Montessori (LC)	114	19	121	41	80%
Breakthrough	124	13	29	39	75%
Metropolitan Learning Ctr	162	7	270	134	75%
U of Hartford Magnet	188	17	54	136	61%
CT Baccalaureate	27	5	45	70	49%
Greater Hartford Acad Math & Sci (LC)	59	17	44	91	49%
Two Rivers Middle	127	7	149	313	46%
Great Path at Manchester Comm Coll	9	2	15	39	37%
Greater Hartford Acad of the Arts (LC)	59	10	57	254	31%
TOTAL magnet school enrollment	1,955	198	1,016	1,186	68%

These magnet enrollment patterns pose a serious problem for school administrators who often give priority to White students to achieve racial balance, thereby allocating seats away from Black and Latino students who also have applied. As a result, the perplexing balancing act to reach the goals proposed in the *Sheff* settlement raises concerns for many in the public. *Hartford Courant* columnist Stan Simpson asserts his frustration with the current magnet desegregation anomaly. He states, "…is a little unsettling…most White students haven't been historically disenfranchised, discriminated against or relegated to inferior public institutions. Now, many get an edge in enrolling at some of the city's promising schools" (Simpson, 2004). School officials and leaders have the difficult task of addressing these critical issues because their policy shapes the prized educational opportunities afforded to some and denied to others.

These local debates in Hartford reflect an extensive national debate over magnet schools and equity. Critics charge that magnet schools engage in "creaming," or attracting only the most desirable students, whether measured by achievement levels, socio-economic status, parental involvement, or a preferred racial background. Mass media reports have sometimes accused magnet schools of being elitist and moving the nation "toward a two-tiered system of public education… skim off top students and teachers and garner a disproportionate share of resources, leaving nonselective neighborhood schools to struggle with disproportionate numbers of tough-to-educate low-income students" (Linnon et. al, 1991). Some writers have also labeled magnet schools as a "new and improved sorting machine" because in practice not all students have the option of attending one. For instance, magnet schools with selective admission criteria such as entrance exams, behavior records and requirements for previous

coursework can promote inequity because students at risk (low-achieving or behavioral problems) who have the greatest learning needs are not benefiting from such admissions requirements (Moore & Davenport, 1989). Also, even magnet schools without restrictive admissions practices (such as a lottery) have the potential to introduce inequities. In some cases, parents have been encouraged by school principals and other staff to lie about their racial background, or to declare that they had a non-existent sibling in the school, in order to gain an advantage for admission into that school (Moore & Davenport, 1989).

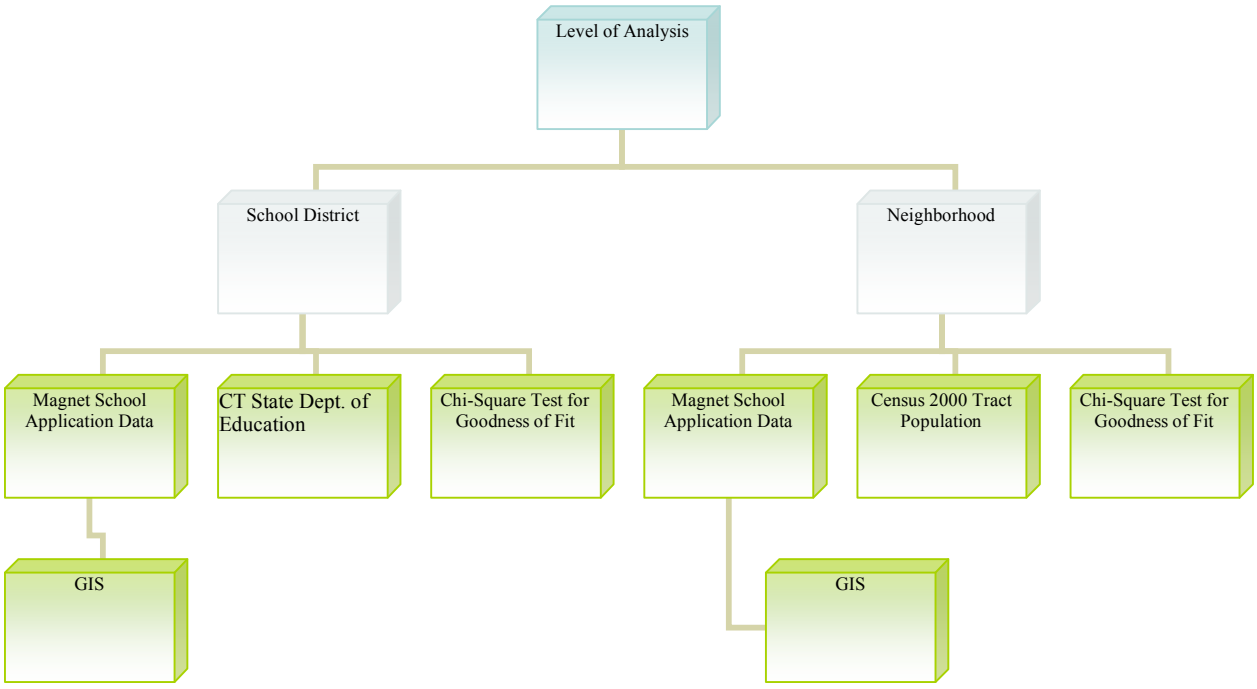
But actions that are commonly labeled as "creaming" by schools sometimes might be better interpreted as "climbing" by parents who are using all of their resources to gain an advantage for their children. Both "creaming" and "climbing" pose challenges for equity, but they differ on agency: actions of the school versus those of families. Smrekar & Goldring (1999) have shown that magnet schools are more likely to enroll better-educated, higher-income, and employed families, across all racial groups. Metz (1989) maintains that parents who are more educated and wealthy are more likely to pursue and research educational alternatives for their children, who are more likely to be high achievers and well-behaved students in class. Archbald (1996) found that neighborhoods with higher proportions of college-educated people had higher rates of students enrolled in magnet schools, which may be correlated with better access to information about choosing a magnet school for their child. Consequently, Whites and middle class parents may disproportionately benefit from a magnet school because they have mastered the admission process, leaving many minority and low-income students who cannot easily exercise choice at an unequal disadvantage. These actions underscore how inequities may

be caused by the social "climbing" of families seeking better advantages through schooling, not only the "creaming" actions of schools themselves.

While this study does not attempt to answer whether "creaming" or "climbing" is occurring in Hartford magnet schools, we simply wish to acknowledge that inequities may potentially be caused by school policies and practices as well as the aggregated effects of thousands of families seeking the proverbial American Dream.

Methodology

The main purpose of this study is to statistically compare magnet school application data to geographic data (District and Neighborhood) to see if magnet school applicants are statistically representative of the residential demographics they come from. To conduct the analysis, we had to draw information from magnet school application data, school district enrollment data and Census 2000 data. We also performed a chi-square test for goodness of fit statistical analysis and a spatial analysis using Geographic Information Systems (GIS). The diagram below illustrates the levels of analysis and sources used in the study.



Although there are a total of 19 inter-district magnet schools in the Hartford region, we have only chosen to do an in depth racial analysis on one magnet school. This magnet school is the Montessori Magnet School (MMS), a pre-K-to-grade 6 institution

located across the street from Trinity College at the Learning Corridor. We chose to do an in-depth racial analysis of MMS because it was one of the few schools that obtained both students' street addresses and race in application data for 2005-2006 for the neighborhood analysis. Other schools, such as the University of Hartford Magnet School, provided student street addresses but did not include race in the computer summaries of application data. We only chose race as a variable to analyze because it was possible conduct this analysis at both the district and neighborhood level, comparing student district enrollment and individual applicants to the magnet school. The same methods could be applied to student achievement (if individual standardized test scores were available) or socio-economic status or parental education (if that data were included in the magnet application forms, which is not the case at present in Hartford).

School District Level

A. Enrollment Data

The school district enrollment data for 2001-04, by race, was downloaded for 8 selected districts from the Connecticut State Department of Education website at www.csde.state.ct.us/public/cedar/districts/index.htm. These districts were chosen because of the number of MMS applications received from each school district, which as will be explained later is important for the chi-square analysis. Table 1 below shows an example of the compiled district data.

Table 1. *Select School District Enrollment from 2001-2004 by Race*

District	Total Hispanic	Total White	Total Black	Total Asian	District Total
Bloomfield	**495**	553	9057	97	10202
East Hartford	**8487**	10647	10494	1647	31275
Hartford	**47633**	4588	36111	796	89128
Manchester	**4280**	19352	5704	1338	30674
New Britain	**21045**	12738	7294	1017	42094
West Hartford	**14107**	27163	3504	3148	47922
Wethersfield	**1180**	12121	581	389	14271
Windsor	**1331**	7734	7962	739	17766

B. Application Data

Similar to the school district enrollment data, we obtained MMS application data from 2001-05, by race, for the same 8 school districts. We also formatted the application data by calculating student percentages by race for each school district which was crucial information for the chi-square analysis. Table 2 illustrates basic MMS student data by school district for 5 years.

Table 2. *MMS Application Data by Race and School District: 2001-2005*

Sending District	Hispanic	White	Black	Asian	Total Apps
Bloomfield	**5**	8	90	2	105
East Hartford	**36**	21	38	3	98
Hartford	**423**	84	450	32	989
Manchester	**15**	25	23	5	68
New Britain	**14**	18	14	7	53
West Hartford	**30**	46	31	14	121
Wethersfield	**11**	29	6	8	54
Windsor	**12**	27	69	4	112

C. Chi-Square Test

The chi-square test for goodness of fit is an inferential statistic that allows a meaningful analysis of one nominal variable (independent variable) but no continuous variable (dependent variable) in one population to a different population with the same variable (Glass & Hopkins, 1984). For example, in the case of this research we ask the question: is the percentage of Black (nominal variable) students who apply to the MMS greater or less than expected by chance? Or, greater than or less than the percentage of Black students enrolled in the school district?

In order for the chi-square test to work well some sources suggest that no more than 20% of the cells should have expected frequencies less than 5 (Morgan, 2001). However a chi-square statistic can be accurate even if the expected frequency is as low as 2 (Camilli & Hopkins, 1977, 1979; as cited in Glass & Hopkins, 1984). Therefore, for this research we decided to select towns that had expected frequencies that were greater than five. We also chose towns that had application data for all years from 2001-2005. However, as will be discussed later, at the neighborhood level I decided to use the rule that only census tracts with total observed applications of 2 or more would be analyzed. Table 3 shows an example of a chi-square analysis conducted at the district level.

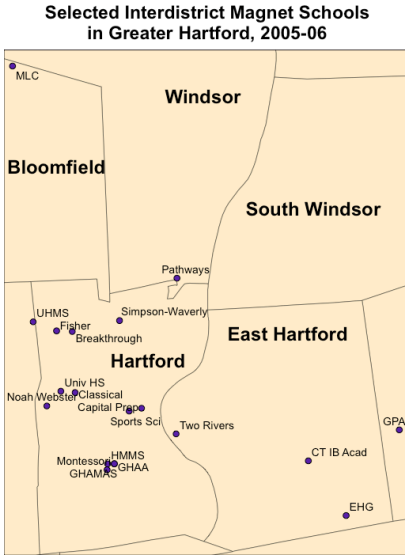
Table 3. *Illustration of Computation of the Chi-Square Test of Goodness of Fit from Student Percentages for East Hartford.*

District Enrollment 2001-2004				*MMS Apps 2001-2005*		
East Hartford	Observed	Percentage		Observed	Percentage	Expected
White	10647	0.34		21	0.18	39.87
Hispanic	8487	0.27		36	0.30	31.78
Black	10494	0.33		58	0.49	39.30
Asian	1647	0.05		3	0.03	6.17
Total				118		
Chi-square	2572.10					
p<.001	Sig					

$X^2 = (118-39.87)^2/39.87 + (118-31.78)^2/31.78 + (118-39.30)^2/39.30 + (118-6.17)^2/6.17 = 2572.10$
Degrees of Freedom (df) = 3
p <.001

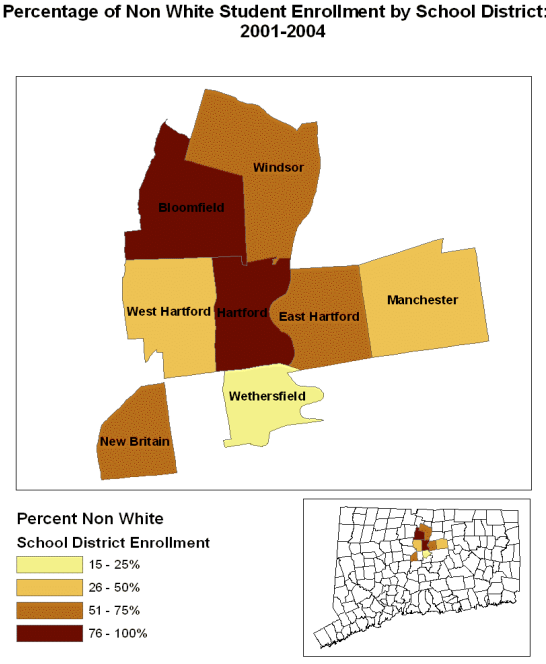
D. GIS Analysis

Map A. *Location of Magnet Schools*



Geographic Information Systems is a collection of tools that allow one to examine geographic problems. To work with GIS is mainly to work with maps. GIS are everywhere from transit, water and police departments to even the tax assessors office (Ormsby et. al, 2004). Map A and B are examples of a maps one can create using ArcGIS which is a computer software program that allows you to create maps and conduct spatial analyses. We used ArcGIS to illustrate magnet school application patterns for this study. In order to develop some of the maps, we had to join magnet school application data such as percentage of students who applied to MMS, to geographic spatial data such as towns in Connecticut and then symbolized the data by groups represented by colors. More examples of these maps will be illustrated in the Findings section of this study.

Map B.



Neighborhood Level

A. Application Data

Using the power of GIS, we conducted a neighborhood-level analysis of magnet application data that was more detailed than the district-level analysis. In particular, this analysis required street-level addresses on students' applications, which we obtained through a confidentially agreement with the Capitol Region Education Council (CREC). (See copy of the agreement in the appendix.)

The level of geography that we chose for the neighborhood analysis was Hartford city census tracts. We only chose to conduct an analysis of Hartford city census tracts for Black and Hispanic applicants and not of other census tracts in different towns because there were not enough White or Asian applicants at the census tract level to make an insightful analysis. As previously mentioned, we decided to only select those tracts that had a minimum acceptable total observed applicants of two because it was less restrictive and the chi-square test is still accurate with small samples (Glass & Hopkins, 1984). Finally, although we had access to application datafrom 2001-2005, we only had student street addresses for 2005-06 because CREC's application database had been changed as the students move to different locations and their records were updated. Consequently, it would be impossible for us to decipher which students have changed their addresses and which students have not. As a result, the probability that we could have some students in the sample size represented more than once increases, therefore making it possible to achieve unrepresentative results.

B. Census 2000 Tract Population Data

Racial demographics for neighborhood level analysis were downloaded from the Census 2000 American Fact Finder at www.factfinder.census.gov. We chose the Hartford city census tracts in SF1 data set because it contained education variables rather than just general population variables. We then created a custom table for the specific variables. For instance, we chose census tract, Connecticut State and Hartford County as our geography. We then chose the variable P12 which was sex by age of the total population of school age students 5-17 for both males and females. We downloaded White, Black, Hispanic, and Asian racial data for the total population and then broke it down to the 5-9 age groups because it is the approximate age span of students enrolled in the Montessori magnet School. By looking at students in those census tracts ages 5-9, we conducted a more accurate statistical analysis by comparing student census tracts demographics with student applications. Table 3 shows an example of the downloaded census data.

Table 4. *Illustration of Census 2000 Tract Population Data*

GEO_ID	SUMLEVEL	GEO_NAME	P012002	P012004
Geography Identifier	Geographic Summary Level	Geography	Total population: Male	Total population: Male; 5 to 9 years
14000US09003330100	140	Hartford County,	1006	77
14000US09003400100	140	Hartford County,	3392	241
14000US09003400200	140	Hartford County,	2252	202
14000US09003400300	140	Hartford County,	3203	215
14000US09003405100	140	Hartford County,	1461	85
14000US09003405200	140	Hartford County,	2210	128
14000US09003405300	140	Hartford County,	2859	182

C. Chi-Square Test

The chi-square test at the neighborhood level was computed similarly to the one at the school district level. However, as noted previously, the variables used were different because we only used Black and Hispanic applicants for 2005-06 application year and compared those applicants with Census 2000 school aged students living in only Hartford city tracts. Table 5 shows an example of the chi-square analysis at the neighborhood level.

Table 5. *Illustration of Computation of the Chi-Square Test for goodness of Fit from Student Percentages in One Census Tract*.

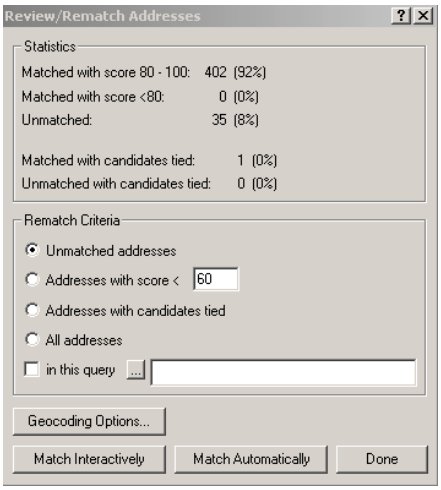
Census 2000 Tract Population age 5-9				MMS Applicants 05-06		
9003504800	Observed	Percentage		Observed	Percentage	Expected
Black	78	0.23		5	0.45	2.49
Hispanic	186	0.54		6	0.55	5.93
Total				11		
Chi-square	33.474463					
p < .001 Sig						

$\chi^2 = (11-2.49)^2/2.49 + (11-5.93)^2/5.93 = 33.47$
df (1)
p < .001

D. GIS Analysis

Since the neighborhood analysis was more complicated than the school district level analysis, we had to use GIS tools to help strengthen the spatial analysis. Using a process known as geocoding, which essentially takes street address information and plots it as a point on a street map, we were able to visualize where the student

Image A: *Geocoding Dialog Box*



applicants live and therefore know specific information about their location's demographic information. In order to geocode, we first obtained (through a confidential agreement with CREC) individual MMS applicants' street address data (reference dataset) in an Excel file. After cleaning and formatting the Excel file for the analysis, we converted the Excel file into a database file (dbf). ArcGIS 9.1 then matches (see Image A) the street addresses with a street map (a shapefile). Some addresses may not be recognizable by the program which then requires one to match the addresses interactively.[1] After the addresses are matched the program plots the exact location of the addresses on street segments (features) as individual points on the map (geocoding). We then placed (overlayed) any boundary lines that we wished to view on the map (such as census tracts or elementary school attendance zones) to help distinguish sections for the analysis. These sections can additionally be distinguished by adding colors (graduated color ramp) to symbolize density or direction. Finally, we removed the individual addresses by combining them by census tract (a spatial join) to protect family confidentiality so that no individual applicant can be identified. Simply stated, the program "throws" away the addresses and compiles the information attached to the address to be symbolized by different colors or symbols. Sequentially, images 1-6 briefly illustrate the gecoding process.[2]

[1] Those addresses that remained unmatched after this process, due to data entry errors or fictitious addresses, were discarded and not used for the analysis.

[2] Many of the skills needed for the GIS analysis were learned at a two-week Faculty/Student immersion GIS workshop sponsored by the National Institute for Technology in Liberal Education (NITLE) at Middlebury College in the summer of 2005.

Image 1: Application data: Street Address

	A
1	Applications
2	35 Main St
3	606 First Ave
4	58 South Blvd
5	49 Main St
6	500 First Ave

Image 2: Street Map

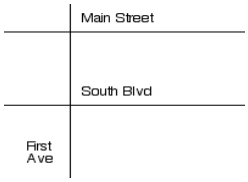


Image 3: Street Map With addresses (dots)

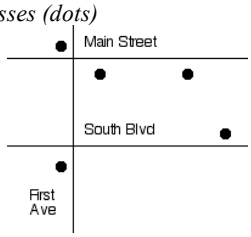


Image 4: Neighborhood boundaries overlayed on street map

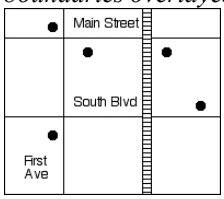


Image 5: Data Groups represented by colors

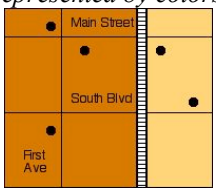
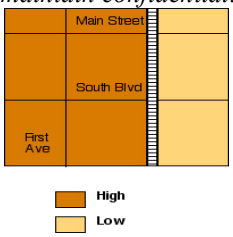


Image 6: Dots remove to maintain confidentiality



Ethical Standards

Although our study involved archival data and we did not interact with human participants, an Institutional Review Board form was filled per request of the Capitol Region Education Council (CREC) to ensure confidentiality of records. In addition, a memo of understanding was created to clarify the arrangements made between CREC and Trinity College researchers. Please see appendix for more details.

Findings

School District Level

At the school district level, disproportionate numbers of students are applying to MMS. Specifically, as shown in Table 6, most applicants are coming from Hartford with a total of 61% of applications over 5 years. Further, MMS applicants also vary by race and school district as illustrated in Table 7. For instance, in Hartford, the majority of the applicants were Black and Hispanic, 45% and 43% respectively. In contrast, over half of the applicants in Wethersfield were White (53%) while only 11% were Black applicants. In additional, Figure 1 shows the collective distribution of applicants by race over 5 years. Again, Blacks and Hispanics had the most applications with a total of 45% for Blacks and 33% for Hispanics. There were only 16% and 5% White and Asian applicants respectively over the five years.

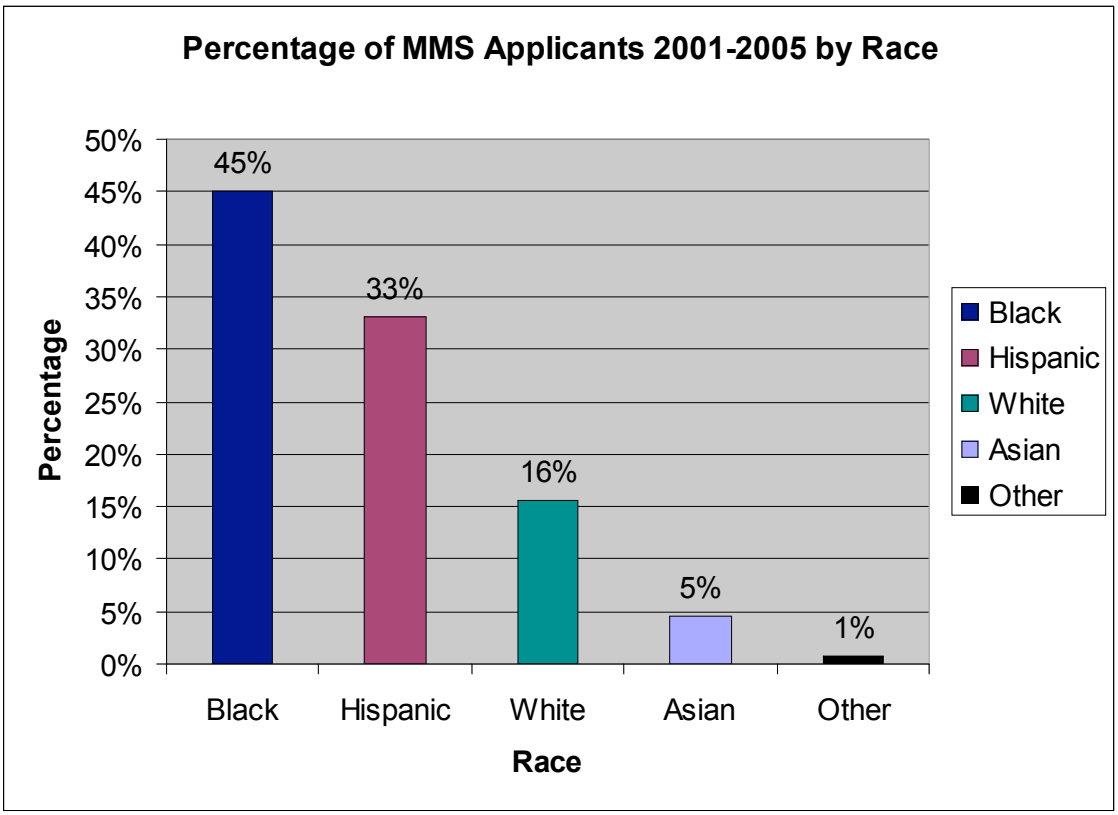
Table 6. *MMS Applicants from 2001-2005 by School District*.

SendingDistrict	Total Apps	Percent
Bloomfield	105	6.5%
East Hartford	118	7.3%
Hartford	989	61.0%
Manchester	68	4.2%
New Britain	53	3.3%
West Hartford	121	7.5%
Wethersfield	54	3.3%
Windsor	112	6.9%

Table 7. *Percentage of MMS Applicants by Race and School District*

SendingDistrict	Hispanic Percent	Black Percent	White Percent	Asian Percent
Bloomfield	4.8%	85.7%	7.6%	1.9%
Windsor	10.7%	61.6%	24.1%	3.6%
East Hartford	30.5%	49.2%	17.8%	2.5%
Hartford	42.8%	45.5%	8.5%	3.2%
Manchester	22.1%	33.8%	36.8%	7.4%
New Britain	26.4%	26.4%	34.0%	13.2%
West Hartford	24.8%	25.6%	38.0%	11.6%
Wethersfield	20.4%	11.1%	53.7%	14.8%

Figure 1. *Percentage of MMS Applicants by Race for 2001-2005 at the School District Level*



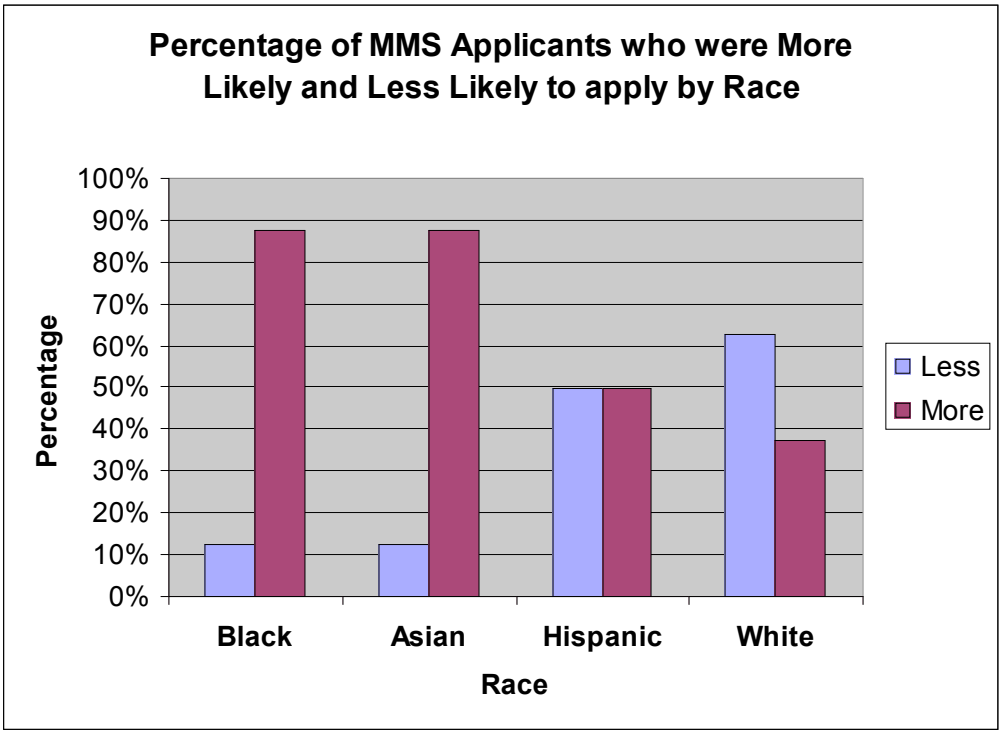
Chi-square analyses at the school district level reveal that the uneven numbers of MMS applications by race are statistically significant. For instance, Table 8 shows that all 8 school districts had statistical significance at the α .001 level. However the direction of this significance varied by race. For example, White applicants who lived in Hartford were more likely than expected to apply to MMS while Hispanics were less likely than expected to apply, χ^2 (3, N = 989) = 128817.59, p<. 001. In contrast, White applicants from Wethersfield were less likely to apply than there numbers would suggest while Black and Hispanic applicants were more likely to apply, χ^2 (3, N = 54) = 3651.68, p<. 001. Figure 2 illustrates the percentages of applicants by race who were more likely or less likely to apply.

Finally, GIS analyses also demonstrate unique application patterns by school district and race. In general, the patterns reveal that Black applicants were less likely to apply to MMS if they resided in Bloomfield, while Hispanics were less likely to apply to MMS if they resided in Hartford, West Hartford, New Britain and Bloomfield. Asians were only less likely to apply if they were from East Hartford, while Whites were less likely to apply if they resided in East Hartford, West Hartford, Wethersfield, Manchester and Windsor. Maps 1-4 show these patterns.

Table 8. *Statistical Significance by School District*

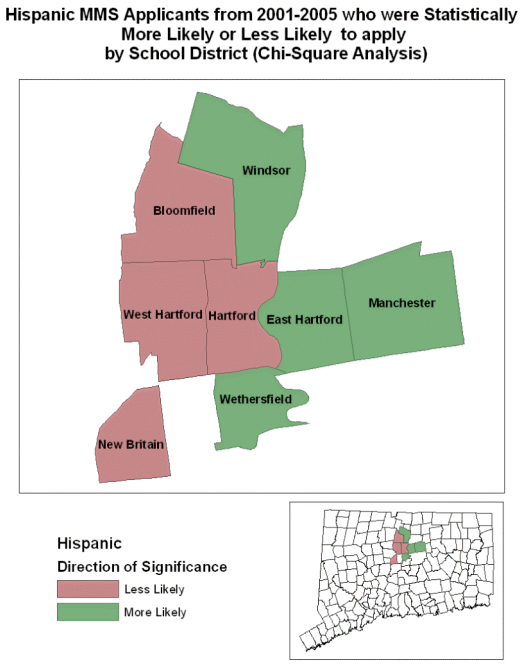
SendingDistrict	Significant	P- Value
Bloomfield	Yes	* p <.001
East Hartford	Yes	* p <.001
Hartford	Yes	* p <.001
Manchester	Yes	* p <.001
New Britain	Yes	* p <.001
West Hartford	Yes	* p <.001
Wethersfield	Yes	* p <.001
Windsor	Yes	* p <.001

Figure 2. *Percentage of MMS Applicants by Race who were More Likely and Less Likely than expected to Apply from 2001-2005.*

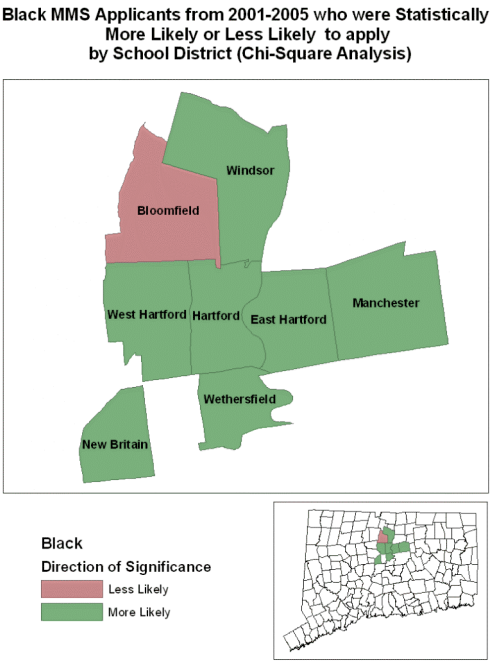


Map 1-4: *Illustration of MMS Applicants by Race for 2001-2005 who were Statistically More Likely or Less Likely to apply by School District.*

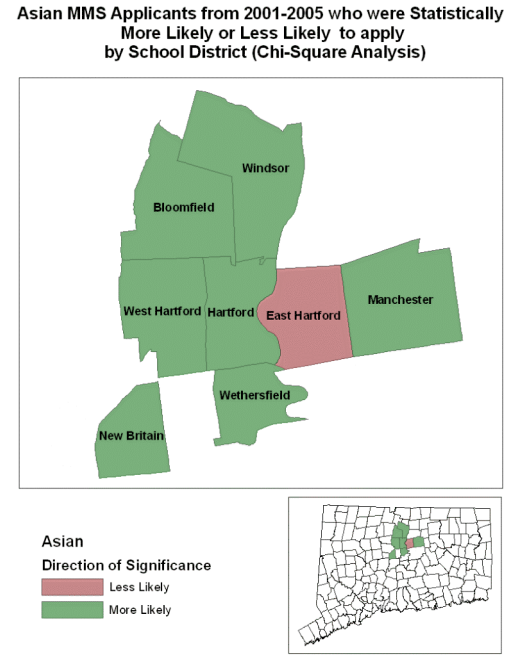
Map 1.



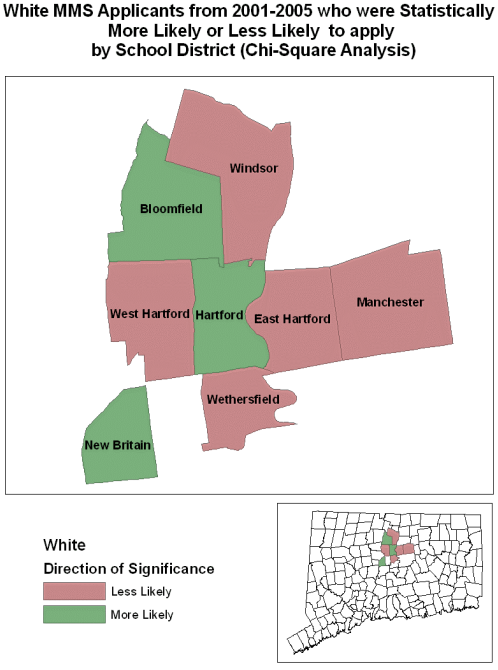
Map 2.



Map 3.



Map 4.



Neighborhood Level Findings

Student application data for the 2005-06 school year and Census 2000 Hartford city tract population indicate that families are applying to MMS at unequal numbers by race. Similar to the trends observed at the school district level, more Black and Hispanic families are applying to the MMS by census tract. For instance, in census tract 23, there were no White applicants. However, a substantial 69% and 31% of the applicants were Hispanic and Black respectively. Table 9 and 10 shows the raw number of applicants and percentage of applicants by selected Hartford city tracts with 7 or more total applications.

Table 9. *MMS Application data 2005-06 by Race and Selected Hartford City Census Tracts*

Tract	Hispanic	Black	White	Other	TOTAL
09003502300	11	5	0	0	16
09003502800	11	2	0	1	14
09003502700	3	9	1	0	13
09003504800	6	5	1	1	13
09003500100	8	3	0	1	12
09003503900	1	11	0	0	12
09003502400	4	6	1	0	11
09003502600	6	4	1	0	11
09003503000	10	0	1	0	11
09003504900	6	4	1	0	11
09003503800	2	5	0	0	7
09003504400	1	3	3	0	7

Table 10. *Percentage of MMS Applicants by Race and Selected Census Tracts for 2005-06*

Tract	Percent Hispanic	Percent Black	Percent White
09003502300	69%	31%	0%
09003502800	79%	14%	0%
09003502700	23%	69%	8%
09003504800	46%	38%	8%
09003500100	67%	25%	0%
09003503900	8%	92%	0%
09003502400	36%	55%	9%
09003502600	55%	36%	9%
09003503000	91%	0%	9%
09003504900	55%	36%	9%
09003503800	29%	71%	0%
09003504400	14%	43%	43%

Chi - square tests for Black and Hispanic applicants at the census tract level demonstrate that the uneven numbers of applicants by tract are statistically different. For example, 72% of the 43 tracts in Hartford showed statistical significance while 12% did not show statistical significance and 16% were not applicable. Chart 2 below illustrates this distribution.

Additional racial tract analyses shed light on a tendency for Black applicants to be more likely than their numbers would suggest to apply to MMS, but show a different

trend for Hispanic applicants. For instance, 55% of Black applicants were more likely to apply while only 19% of Hispanic applicants were more likely to apply to MMS than expected. Instead, 48% of Hispanic applicants are applying to MMS as expected while 29% of Black applicants are applying at a rate that would be expected. Even more specific, in census tract 9003502400, Blacks were more likely to apply than expected while Hispanics were less likely to apply than expected, χ^2 (1, N = 10) = 33.90 p<. 001. Table 11 and Chart 3 further demonstrates this pattern.

Chart 2. *Pie Chart showing the Percentage of Hartford City Census Tracts for 2005-06 With and Without Statistical Significance*.

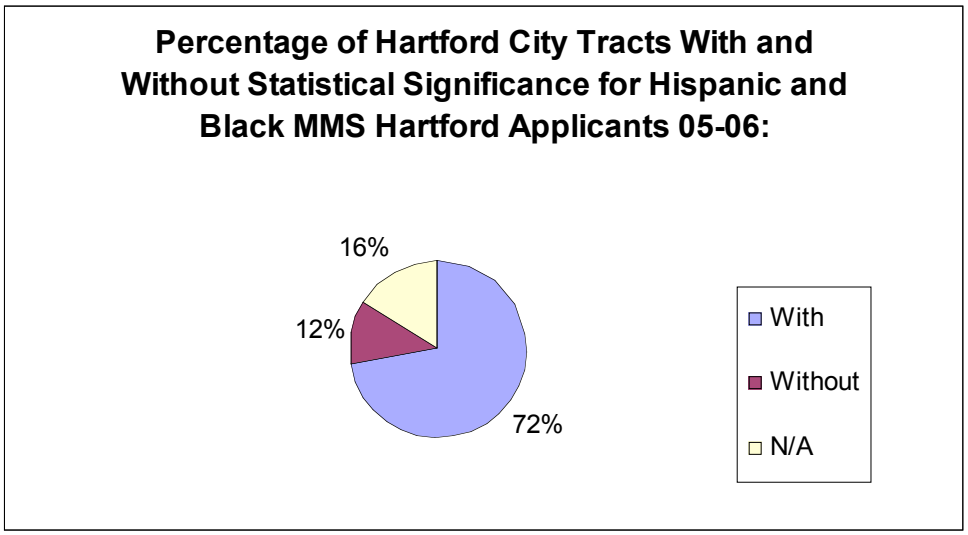
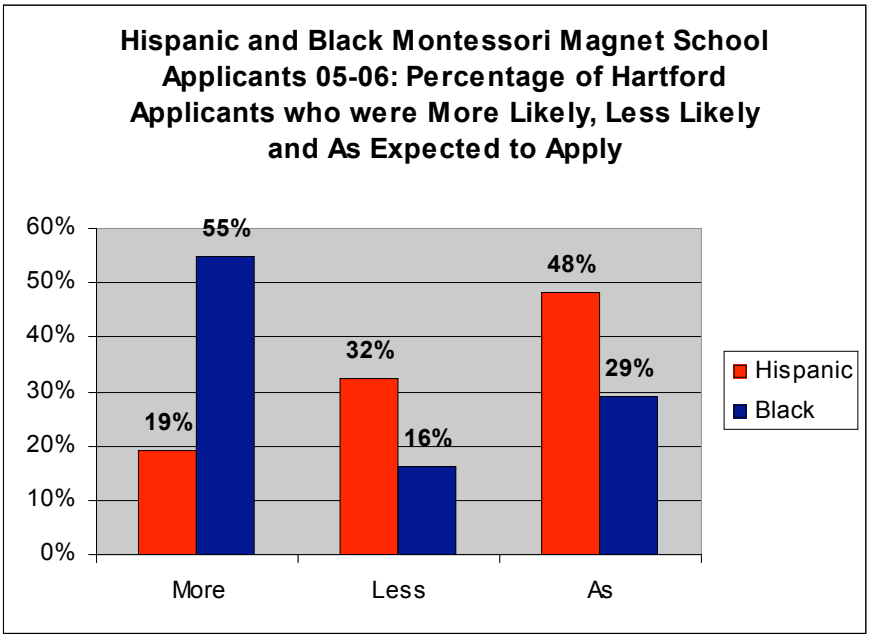


Table 10. *Black and Hispanic Applicants that were More Likely (M), Less Likely(L) and As Expected(A) to Apply by Selected Census Tract.*

Tract	Statistically Significant	Hispanic (more, less, as expected)	Black (more, less, as expected)
09003500100	Y	A	M
09003500200	Y	A	A
09003500300	Y	L	M
09003500400	Y	A	M
09003500500	N		
09003500700	N/A		
09003500900	Y	A	A
09003501000	Y	L	M
09003501100	Y		
09003501200	Y	L	M
09003501300	N		
09003501400	Y	A	A
09003501500	Y	M	L
09003501700	N		
09003501800	Y	A	A
09003502100	Y		
09003502300	Y	M	M
09003502400	Y	L	M

Chart 3. *Percentage of Hispanic and Black MMS applicants for the 2005-06 school year who were More likely, Less Likely or As Expected to apply by Selected Census Tracts.*

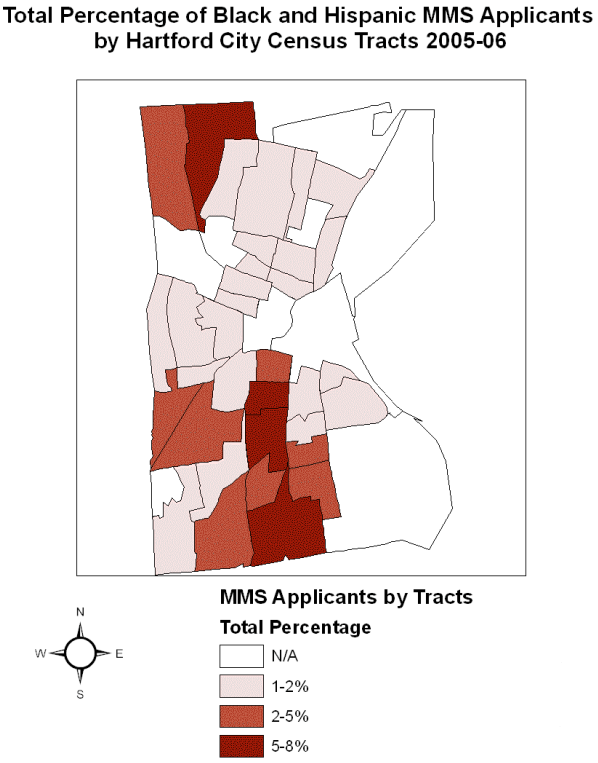


GIS spatial analyses illustrate geographic patterns that reveal application trends in specific Hartford city census tracts. For instance, the higher percentages of students applying to MMS were located in the North End and South End of Hartford with 5-8% of the applications located in these areas. Map 5 shows the distribution of applications in Hartford city census tracts. Furthermore, broken down by race, most tracts with 75-100% for Hispanic applicants were located in the South End and North End of Hartford while most tracts with 75-100% of Black applicants were located in the North End (As shown in maps 6-7).

GIS spatial analyses of chi-square statistical tests have also demonstrated discrepancies between Black and Hispanic MMS applicants at the census tract level. As shown in Map 8, Hispanics were less likely to apply if they resided in the West End, but

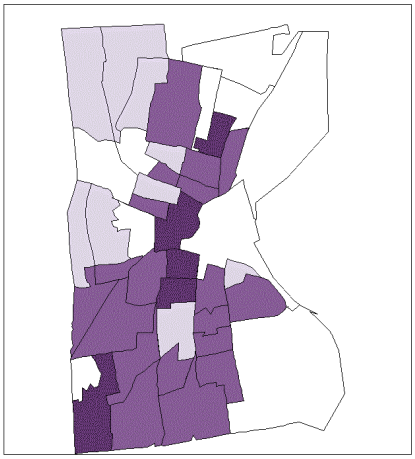
were more likely to apply in small parts of the South End and North End of Hartford and as expected to apply in most parts of Hartford. Unlike Hispanic applicants, Map 9 shows that Black applicants were statistically more likely to apply to MMS if they resided in the West End, South End and clusters of the North End of Hartford. These trends support the claim that MMS applicants are not always statistically representative of the geographic demographics from which they reside in.

Map 5. *Percentages of 2005-06 MMS Applicants by Hartford City Census Tracts*



Map 6.

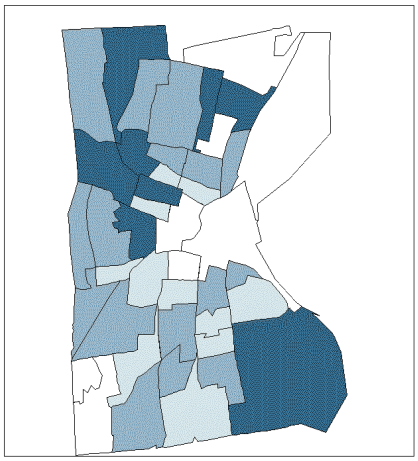
Percentage of Hispanic Applicants 2005-06
by Hartford City Census Tracts



Hispanic Applicants
0
1 - 33%
34 - 75%
76-100%

Map 7.

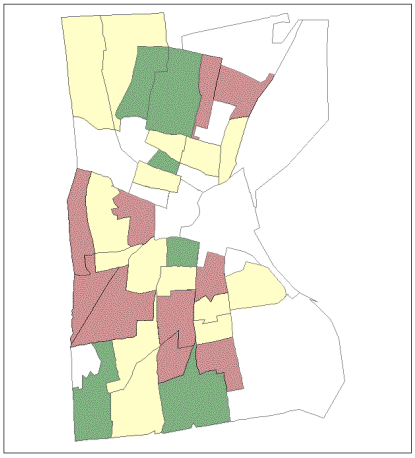
Percentage of Black Applicants 2005-06
by Hartford City Census Tracts



Black Applicants
0
1 - 33%
34-75%
76-100%

Map 8.

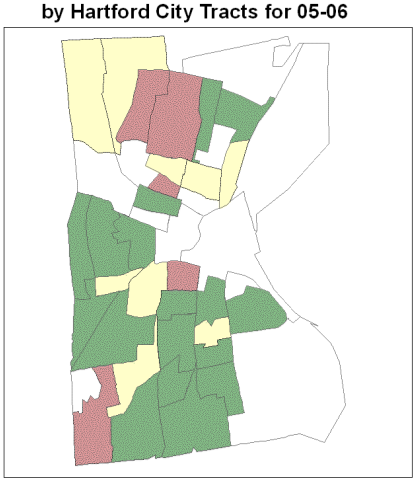
Hispanic MMS Applicants who were Statistically
More likely, Less likely and As Expected to apply
by Hartford City Tracts for 05-06



Hispanic Applicants (Statistical Significance)
N/A
A
L
M

Map 9.

Black MMS Applicants who were Statistically
More likely, Less likely and As Expected to apply
by Hartford City Tracts for 05-06



Black Applicants (Statistical Direction)
N/A
A
L
M

Discussion

In a social climate where educational opportunities are strongly linked with race and class, there is an unsettling knowledge that the nature of these educational opportunities are not equal for all. Even more alarming is the fact that race has also become synonymous with space, such that the phrase "racialization of urban space" has been coined to describe how housing for Blacks and Latinos have been restricted to urban cities as a result of racism and uneven development (Gotham, 2002).

In an attempt to remedy the social disparities that exist in the current social order, magnet schools have become a popular reform tool to equalize and desegregate our society. These magnet schools were designed with special curricular opportunities emphasizing the sciences, arts and technology in order to attract families of different demographics to their schools. Most magnet schools are located in urban areas in hopes to draw both the disadvantaged families that reside in the urban areas and the more affluent families from the suburbs. The rationale behind these magnet schools was that by attracting a diverse mix of families, schools would become more ethnically and socio-economically diverse and less racially segregated. However, as shown in our analysis, magnet schools are not without conflict, and some critics question their ability to attract all families equally.

The results of our study indicate that families are not applying equally to MMS. At both the district-level and the neighborhood-level, more Hispanics and Blacks are applying than Whites and Asians. At a more focused neighborhood analysis, Hispanics

are only 19% statistically more likely to apply to MMS while Blacks are 55% statistically more likely.

One might speculate that these findings could potentially be caused both by the actions of school systems or those of individual families. For example, magnet school marketing efforts may not be reaching White and Asian families as readily as they are reaching Black and Hispanic families. Or White families from the suburbs may be satisfied with their current school choice for their child, or fearful of schools located in the city of Hartford, while Black and Hispanic families may be feeling pushed away or disappointed in the quality of education their child receives from their neighborhood public school.

In any case, these findings reflect the spirit of the local debate that more racial minorities are applying to MMS than Whites and calls attention to the challenges faced by policymakers as they struggle to find a solution to magnet school imbalance. In addition, these findings may cause some to wonder if it really should be alarming that more racial minorities are applying to magnet schools, when the fact of the matter is that these schools were designed to provide better educational opportunities to the disadvantaged.

At the neighborhood level, a surprising finding was that Hispanics were more likely to apply if they resided in the North End of Hartford (which is a predominantly Black residential area of Hartford), while Blacks were more likely to apply if they resided in the South and West End (which are predominantly Hispanic neighborhood)s. These findings could possibly suggest a trend in minority vs. majority relationships. Perhaps, because Hispanics are the minority in the North End of Hartford they are seeking to

educate their children outside of the North End and vice versa for Black applicants. Also, the fact that Blacks overall were applying more readily to MMS than Hispanics, could suggest a difference in the way that Hispanics and Blacks feel about enrolling their children in school at the age of 3 in this pre-K school, which is earlier than the average school enrollment age of 5.

Although there is no simple solution or one best way to address the current magnet school controversy, some recommendations can be made to facilitate parents' rights to exercise choice. For instance, since Asian families are not applying as readily as Black and Hispanic families, marketing efforts should focus on disseminating information to target more Asian populations and to cater to the language needs that may pose as barriers to these families.

Equal educational opportunities are a right that should be available to all and should not be dependent on one's race or socio-economic class. Although tension will always exist on what is considered the best or right way to improve the quality of education in our school system, that tension should not overpower the necessity of doing what is in the best interest of the child. The challenge rests not simply on reforming education, but genuinely recognizing the needs of those who will be affected by it the most.

Finally, by investigating if magnet schools are attracting families equally, this research can pave the way for future investigators to analyze several other components of magnet school equity. For instance, conducting a comprehensive qualitative analysis of why Hartford region parents choose magnet schools will be helpful in understanding the decision making process. Also, a study looking at inter-racial relationships in magnet

schools will shed light on the process of integration in these schools. Most importantly, with these studies, policy makers will be forced to reexamine if magnet schools are an appropriate tool for improving educational outcomes for all.

Limitations of the Study & Potential for Future Research

Methodological limitations of this study should not be overlooked. There could have been several factors affecting the results of this study. One important factor is that the application data itself may have not been accurate. The application data received in the Excel worksheet from CREC were typed in manually and could have had errors. Also, the applicants themselves may have provided faulty information in order to improve their chances of getting accepted into the lottery.

The data used from Census 2000 was not the most precise data to use because it has almost been 6 years since it first became available and since that time the census tract demographics in Hartford could have changed. A more accurate comparison would have been to use census tract demographics for the same year that as the application data, but it was obviously not available.

Future studies in the city of Hartford should conduct an in depth application pattern analysis on all 19 magnet schools and compare findings from school to school. In addition, quantitatively and qualitatively examining parental motivations for applying to magnet schools could help inform policy makers and help us better understand the context of magnet schools. Finally, in order to add meaningful findings to the debate on creaming, future studies should use additional variables such as income and student achievement.

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Authorship:

This paper represents a collaborative effort between the co-authors. Naralys Estevez will receive her undergraduate degree from Trinity College in May 2006, with a dual major in Educational Studies and Psychology. She performed most of the GIS tasks, conducted the statistical analysis, created tables and maps, and wrote the first draft as part of her senior research project. Jack Dougherty is Associate Professor and Director of the Educational Studies Program. As the faculty advisor, he assisted the first author by focusing the research question and conceptualizing the study, negotiating confidentiality agreements to obtain the data, providing GIS support, and revising the second draft. The collaboration took part through the Cities, Suburbs, and Schools research project at Trinity College (see more at http://www.trincoll.edu/depts/educ/css)

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Appendix

Memo of Understanding between the
Capitol Region Education Council (CREC) and the
Cities, Suburbs, and Schools research project at Trinity College (CSS) July 27, 2005

The CSS research project agrees to work with CREC to assist with data analysis of **magnet schools**. Either party may revoke this agreement if unsatisfied for any reason.

Specifically, CREC agrees to provide CSS with street address & zip code data for applicants and participants in CREC-managed interdistrict magnet schools. CSS will use our ArcGIS software to sort the data into larger geographical units, such as:

-- elementary school zones (neighborhood schools that students would have attended if they had not participated in the program)

-- census block groups (areas defined by the US Census Bureau, consisting of approximately 1,500 people, which would allow us to infer the demographic characteristics of applicants' neighborhoods)

As a condition of this partnership, CSS remains committed to protecting the confidentiality of individual CREC program participants. CSS promises never to release any street address data (or any other personally-identifying information) obtained in this study. Furthermore, CSS will share all of the products of our research (charts, maps, reports, etc.) with CREC to help identify trends and patterns.

Although this archival research does not involve interactions with human subjects, we have submitted an application to Trinity's Institutional Review Board (IRB) to clarify our arrangements regarding the security of confidential data. All address data obtained from CREC will be stored in a secure CSS subfolder in the Trinity computer server (known as "docex"), which can be accessed via password only by the project director (Jack Dougherty), the ArcGIS student research assistant (Naralys Estevez '06), and the system administrator. Our copy of the address data will be destroyed one year after the conclusion of the study.

_____ _____
CREC signature date

_____ _____
CSS research project signature date

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