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Matthew Di Carlo
Bilan Jama

School Segregation by Race and Ethnicity in the D.C. Metro Area

Abstract

In this research brief, we describe and decompose school segregation by race and ethnicity in the Washington, D.C., metropolitan area, in which we include: the District of Columbia; Alexandria, Arlington, and Fairfax County in Virginia; and Montgomery County and Prince George's County in Maryland. We find only modest segregation within all but one of these six metro area districts, with the sole exception being D.C. proper. Segregation across the entire metro area, however, is moderate to high. The reason for this counterintuitive discrepancy is extensive segregation between the districts. In fact, we find that roughly half of total multiracial segregation (i.e., segregation of white, black, Hispanic and Asian students), and almost two-thirds of the segregation of black and white students, is due to the sorting of students into districts, rather than schools within districts. This means that even if all six D.C. metro area districts were to integrate their schools internally, at least half of total metro areawide segregation would remain intact. Finally, we find that segregation between suburbs is a larger contributor to total metro area segregation than segregation between the city (D.C. proper) and the suburbs. Our results illustrate the importance of between-district segregation as a factor in the overall segregation of students in the D.C. metro area. Absent the movement of students across district boundaries, there is often an "invisible ceiling" on the potential metro areawide impact of even the most successful intra-district desegregation efforts.

Introduction

The Washington, D.C., metropolitan area is among the largest and most affluent in the United States. Whereas the city of Washington, D.C., was once home to the majority of the metro area's population, starting in 1950 the city's population began to decline, while that of the metro area grew rapidly (U.S. Census Bureau). These population shifts were strongly influenced by the desegregation of the city's schools, begun shortly after the landmark *Brown* decision in 1954. School desegregation, in addition to local and federal housing policies and other factors, compelled the flight of white residents from the city into the surrounding Maryland and Virginia suburbs (Kijakazi et al. 2016; Rothstein 2017).

Consequently, throughout the 1950s and into the 1960s, the city's historically large African American population grew while its white population declined with equal speed; African American families expanded into the neighborhoods that white families had left. This dynamic changed during the 1970s, as many middle-class African American families began to flee to the suburbs while the white population stabilized and began to grow again, occupying and gentrifying city neighborhoods. By 2012, the African American population had declined 40 percent from its peak in the 1970s, and Washington was no longer a majority African American city (Orfield and Ee 2017). During this same time period, the immigrant population in the metro area as a whole saw a tenfold increase, with most of that growth occurring in the suburbs outside the city (Tatian et al. 2018).

These population shifts, of course, affected the racial and ethnic composition of the metro area's public schools, resulting in a student population that is remarkably diverse overall. The distribution of that diversity, however, is uneven. Past efforts to measure the extent and effects of school segregation in the D.C. metro area focused on the isolation of African American students in the District proper from their white peers in the surrounding suburbs. The situation today is more complicated. First, as is the case nationwide, the D.C. metro area now serves a more multiracial and multiethnic student population, with significant shares of Hispanic and Asian students. Second, modern school segregation in the D.C. metro area is not a "minority city, white suburbs" matter (and this was never truly the case). Today's regime, in the D.C. metro area and elsewhere, is a combination of segregation both *within* and *between* districts (Reardon et al. 2000).

Suppose we have a hypothetical metro area composed of two districts, and the area's schools as a whole serve a student population that is half white and half African American. To the degree all schools in this area serve students who are half white and half African American, the area's schools would be considered integrated. Two different types of sorting can threaten this integration.

First, the white students in one or both districts may be clustered in certain schools, and the African American students may be clustered in other schools; this is *within-district segregation*. Even if both districts, like the metro area as a whole, are half white and half African American, segregation in this metro area might still be severe due to the intra-district sorting of students into schools by race and ethnicity.

Second, one of these districts may serve a disproportionate number of white students, and the other a disproportionate number of African American students; this is *between-district segregation*. So, we might

have a situation in which both districts are perfectly integrated *internally*, with each school exhibiting the same racial composition as their respective districts as a whole, but there might still be strong segregation in this metro area if most of the black students attend schools in one district and most of the white students attend schools in the other. In other words, without inter-district movement of students, it would be impossible for schools in both districts to achieve the metro areawide racial composition (half white, half African American) because, put crudely, one district would "run out" of white students and the other would "run out" of African American students.

Both within- and between-district segregation play important roles in determining whether the resource of racial and ethnic diversity is shared equally by students attending schools in a given metro area. The distinction is important because contemporary debates about school segregation, as well as the vast majority of voluntary and court-ordered efforts to desegregate schools, have tended to focus on segregation and integration *within* districts. Yet a substantial proportion of modern school segregation regimes, and much of the potential for desegregation, can now be found between districts within metropolitan areas.

Moreover, within- and between-district segregation are somewhat different in terms of their causes and, thus, the types of policies that may be used to address them (Reardon et al. 2000). Between-district segregation is predominantly a function of residential segregation patterns and policies affecting those patterns—where you live determines the district in which your children attend public school. Segregation within districts is also strongly influenced by residential segregation, but school assignment policies can mitigate this relationship by allowing students to attend schools outside of their neighborhoods.

The purpose of this research brief is, using multiple measures, to describe and decompose school segregation by race and ethnicity in the D.C. metro area, with a particular focus on multiracial segregation within *and* between the districts that constitute this area.

Previous Research on School Segregation

Over the past two decades, the race and ethnicity composition of U.S. public schools in general has transformed drastically, with more diversity across racial groups than ever before. This increased diversity, however, has not led to widespread school integration. The degree of segregation, both in any given year and over time, differs by location, the type of segregation, the type of measure used and other factors, including district size and structure (Reardon and Yun 2001).

Attempts to isolate the effects of segregation (desegregation) are even more complicated, due in part to the interplay between race/ethnicity and socioeconomic status. In addition, such causal interpretations require assumptions regarding the relationship between the distribution of resources and student outcomes (Reardon and Owens 2014). Existing research, however, suggests that desegregation reduces the dropout rate for African American students (Guryan 2004) and improves their chances of graduating high school (e.g., Reber 2010). Researchers have also found that desegregation has positive effects on non-academic outcomes for African American students, such as higher incomes, increased

likelihood of having a white-collar job, reduced chances of living in poverty, improved health outcomes and a lower probability of incarceration (Johnson 2015).

The segregation of Latino students is comparable to that of African American students and is growing (e.g., Orfield et al. 2014; Fry 2007), presumably with similar negative effects, especially for foreign-born Latino students (Ryabov and Van Hook 2007).

Conversely, research has found no negative academic effects of desegregation for white students (e.g., Johnson 2015) and indicates that it might be beneficial for all students—i.e., can prepare all students to succeed and improve social cohesion in an increasingly diverse nation by encouraging relationships and reducing prejudice between groups (Pettigrew and Tropp 2006; Mickelson and Nkomo 2012).

Contemporary researchers have increasingly focused on the within- and between-district components of school segregation within metropolitan areas. Reardon et al. (2000), for example, find that, throughout the first half of the 1990s, total segregation in U.S. metropolitan areas was relatively stable, but that the role of between-district segregation during this period grew, while that of within-district segregation declined (also see Clotfelter 1999). This contribution of between-district segregation appears to have stabilized between 1998 and 2009 (Stroub and Richards 2013), but it remains high.

Focusing specifically on the D.C. metro area, Orfield and Ee (2017) find large proportions of "majority minority" schools (90-100 percent non-white) in D.C. proper and Prince George's, whereas schools appear far more integrated in Montgomery, Alexandria, Arlington and Fairfax. That analysis does not address between-district segregation directly, but the results for D.C. and Prince George's suggest that non-white students are disproportionately concentrated in these districts—i.e., between-district segregation.

Data and Methods

Our data are from the Common Core of Data, administered by the National Center for Education Statistics. The analysis presented below focuses entirely on the 2015-16 school year. Additional details about the sample are discussed in the Technical Appendix.

Our analysis of the D.C. metro area includes all charter and regular public schools in the following jurisdictions: Alexandria City (Va.), Arlington (Va.), the District of Columbia, Fairfax County (Va.), Montgomery County (Md.) and Prince George's County (Md.). We excluded several jurisdictions that are sometimes included in the D.C. metro area, as they were too small to be included in our within-district/between-district decompositions, which are the primary focus of this analysis. For the sake of simplicity, throughout this report we refer to the six included jurisdictions as "districts," even though, technically, they include charter schools that serve as their own districts.

In addition, although income-based segregation is interdependent with segregation by race and ethnicity, and the two are often confounded, our analysis will focus exclusively on the latter. Table 1 presents the number of schools and students in our sample, as well as the race and ethnicity distribution of students, by district.

TABLE 1

Number of schools, enrollment and student race and ethnicity distribution, by district, D.C. metro area, 2015-16

Variable	Alexandria City	Arlington	D.C.	Fairfax	Montgomery	Prince George's	TOTAL METRO
Schools	16	32	221	197	204	208	878
Students	14,311	23,902	81,345	175,415	148,551	126,293	569,817
% metro stu.	2.5	4.2	14.3	30.8	26.1	22.2	100.0
Student race and ethnicity distribution (column percentages)							
White	26.7	48.6	10.4	42.3	31.8	4.3	26.5
Black	31.1	11.2	72.3	10.8	22.5	62.7	34.7
Hispanic	36.5	30.6	15.8	26.2	30.7	30.2	27.2
Asian	4.8	9.6	1.5	20.7	15.0	2.8	11.6

Notes: Excludes students coded as "American Indian/Alaska Native," "Hawaiian Native/Pacific Islander" or "Two or more races." D.C. metro area defined as noted in table. See the appendix for more details on the sample. Percentages may not sum to 100 due to rounding.

Almost 570,000 students attend public schools in the D.C. metro area (as we define it), with almost four in five in Fairfax, Montgomery and Prince George's. The District itself is relatively small in comparison with these other districts that share the metro area named after it.

As Table 1 shows, the metro area overall is remarkably diverse, with quite strong representation of white, black, Hispanic and Asian students.[1] In this sense, the D.C. metro area represents an opportunity for truly multiracial and multiethnic schools.

This diversity, however, is maldistributed between districts. For example, 34.7 percent of metro students are black, but black students constitute 72.3 percent of D.C. students and 62.7 percent of students attending schools in Prince George's County (henceforth "PGC"). Similarly, about half of the metro area's white students attend schools in Fairfax, even though that district serves only 31 percent of all students. Only in Montgomery and Alexandria does the racial and ethnic composition of students resemble that of the metro area overall.

In order to unpack segregation in the D.C. metro area, our descriptive analysis will use two different measures: the exposure/isolation index and Theil's information theory (or entropy) index. These two measures are discussed in general terms below. Readers interested in more details should consult the Technical Appendix (also see Massey and Denton 1988).

[1]A note on nomenclature: Under ordinary circumstances, we might prefer to use the terms "African American," "Latino" and "people of color," following what seems to be the current preference of the preponderance of people in each of these groups. However, as the reader will see, when referring to our findings, we use the terms "black," "Hispanic" and "minority," since most data on race and ethnicity in the United States is collected using the categories employed by the U.S. Census Bureau—that is, white, black, Hispanic and Asian.

The **exposure index (EXP)** is a simple, common manner of characterizing the segregation of two groups. If we use the example of white and black students, the exposure index indicates, within a given jurisdiction (e.g., district, metro area) the proportion of the typical white student's peers (fellow students within her school) who are black. This is fundamentally a measure of interaction, or at least the possibility of interaction (Greene and Mellow 1998), between two different groups. It ranges from zero (in our example, the typical white student has no black peers at her school) to one (all of her peers are black). These can also be interpreted as percentages (0-100 percent).

The advantages of this measure are, first, its simplicity and, second, its ability to provide an easy-to-understand characterization of how things look "on the ground." The disadvantages include the fact that it can only compare two groups at a time (a particular problem in a multiracial area such as the D.C. metro area), as well as its sensitivity to the composition of the student population, which complicates comparisons between units (e.g., districts) and within units over time (for more discussion, see: Reardon and Owens 2014; Massey and Denton 1988). For instance, exposure/isolation rates can change simply because the student population changes, even if the students reflecting those compositional changes are spread out between schools within the unit.

Because we are primarily interested in comparing segregation between districts, most of our analysis and discussion will concentrate on the information theory index.

Theil's information theory (IT) index, also known as the entropy index, is based on the dispersion of students across schools within a unit, such as a district or an entire metro area (Theil 1972; Theil and Finizza 1971). For this reason, it is often classified as an "evenness" measure.

The IT index is now common in the segregation literature. In addition to its independence from the composition of the student population, it offers two other advantages for our analysis. First, it can be calculated using multiple groups (i.e., race/ethnicity categories), rather than just for pairwise combinations. This is important given the D.C. metro area's multigroup diversity. Second, the index can be decomposed into within and between components, which, as we will see, provides very useful insight into segregation regimes (Reardon et al. 2000).

The primary relevant disadvantage of the IT index is the fact that it is somewhat difficult to interpret in "real world" terms—i.e., the index, as discussed below, measures segregation in terms of how much schools' diversity varies from that of the overall unit (e.g., district, area, etc.). This difficulty is somewhat less of a problem in our context, however, given that we are focused on comparing districts, rather than characterizing them individually.

As mentioned above, the IT index can be broken down into within-group and between-group (or area) components. This allows us to decompose "total metro areawide segregation" into two parts: the contribution of segregation *within* districts, and the contribution of segregation *between* districts. If, for example, total segregation is driven mostly by segregation between the six districts of the D.C. metro area (as we define it), then the areawide impact of even the most successful efforts to integrate schools in any or all of these districts will be constrained.

A note on charter schools

All of the analyses reported in this brief include charter schools. The results, however, do not include separate estimates for the charter subsector. This is because: 1) the charter subsector is relatively small as a proportion of total metro areawide enrollment; 2) our focus is on the within-district/between-district decomposition; and 3) the results for charter schools are generally very similar to those for regular public schools (and segregation between these two subsectors contributes a negligible amount to total segregation—see Di Carlo and Wysienska-Di Carlo 2017).

Results

Exposure/isolation

Table 2 presents the exposure (and isolation) index values for each combination of students' race and ethnicity, by district and areawide. To facilitate interpretation, these indexes are presented in terms of the average race and ethnicity distribution (%) of the typical student's peers, by the race or ethnicity of that typical student.

Note that the diagonal cells in each panel (white|white, black|black and so on) are not exposure index values, but rather the difference between one and the sum of the three other cells in that row (each of which are exposure index values). This value is known as the isolation index. It provides an idea of the degree to which the typical student is surrounded by peers who "look like them," and/or not surrounded by peers who are racially or ethnically different.

For example, looking at the bottom panel, which applies to the D.C. metro area as a whole, we see that the typical white student attends a school in which 47.9 percent (0.479) of his or her peers are also white (this is the white isolation index). In other words, while about one in four students in the D.C. metro area is white (see Table 1), the typical white student attends a school in which almost half her peers are white. Strikingly, the white isolation index is similar for D.C. proper (45.8 percent), which means that the typical white student in the District attends a school that is almost half white, even though only about 10 percent of the District's students are white.

Conversely, the white isolation index for PGC is 12.3 percent, far lower than it is in any other district in Table 2. This discrepancy between PGC and the other five districts may be due partially to greater segregation within the latter. In reality, however, it is driven mostly by the aforementioned compositional differences between districts. That is, white students are less isolated in PGC than their white peers in the other districts because only 4.3 percent of PGC's students are white. From this perspective, while the exposure and isolation indexes are *within*-district segregation measures, comparing them between districts is often telling us more about compositional differences (and segregation) *between* districts.

TABLE 2

Race and ethnicity distribution of school peers (exposure and isolation indices), by student race and ethnicity and district, D.C. metro area schools, 2015-16

Alexandria City

		Proportion of peers who are			
	Race	**White**	**Black**	**Hisp.**	**Asian**
For the typical student who is	White	.371	.267	.324	.039
	Black	.237	.362	.348	.053
	Hisp.	.245	.297	.409	.050
	Asian	.219	.343	.377	.061

Arlington

		Proportion of peers who are			
	Race	**White**	**Black**	**Hisp.**	**Asian**
For the typical student who is	White	.596	.086	.225	.093
	Black	.374	.162	.357	.108
	Hisp.	.358	.130	.421	.091
	Asian	.470	.126	.291	.113

District of Columbia

		Proportion of peers who are			
	Race	**White**	**Black**	**Hisp.**	**Asian**
For the typical student who is	White	.458	.331	.167	.044
	Black	.048	.855	.090	.008
	Hisp.	.110	.412	.455	.023
	Asian	.313	.375	.248	.065

Fairfax

		Proportion of peers who are			
	Race	**White**	**Black**	**Hisp.**	**Asian**
For the typical student who is	White	.504	.091	.202	.204
	Black	.353	.167	.304	.177
	Hisp.	.326	.126	.379	.169
	Asian	.417	.093	.214	.276

Montgomery

		Proportion of peers who are			
	Race	**White**	**Black**	**Hisp.**	**Asian**
For the typical student who is	White	.465	.157	.215	.163
	Black	.223	.314	.331	.132
	Hisp.	.223	.243	.417	.117
	Asian	.346	.199	.241	.215

Prince George's

		Proportion of peers who are			
	Race	**White**	**Black**	**Hisp.**	**Asian**
For the typical student who is	White	.123	.574	.215	.045
	Black	.040	.738	.196	.026
	Hisp.	.036	.407	.529	.027
	Asian	.073	.579	.291	.057

D.C. METRO AREA

		Proportion of peers who are			
	Race	**White**	**Black**	**Hisp.**	**Asian**
For the typical student who is	White	.479	.147	.211	.164
	Black	.112	.630	.203	.055
	Hisp.	.205	.259	.436	.099
	Asian	.373	.163	.232	.232

Notes: Excludes students coded as "Native American/Alaska Native," "Hawaiian Native/Pacific Islander," or "Two or more races." D.C. metro area defined as noted in table. See the appendix for more details on the sample. Proportions may not sum to 1 due to rounding.

It is therefore instructive to continue to review Table 2 with an eye on the composition of each district presented in Table 1. For instance, Table 2 shows that the typical white student in Montgomery County attends a school in which 15.7 percent of her peers are black. Yet, looking back at Table 1, we see that 22.5 percent of all Montgomery students are black, meaning that black students are underrepresented in the typical white student's school, but not drastically so. Similarly, in Fairfax, the typical black student's school peers are 35.3 percent white, which is modestly lower than the district's white population overall (42.3 percent).

Reviewing each district's isolation and exposure indexes in this manner shows that the typical student of each race or ethnicity attends a school in which peers of her own race or ethnicity are overrepresented vis-à-vis districtwide composition, and peers of other races and ethnicities are underrepresented. But the differences are generally not dramatic, and in many cases they are roughly consistent with what one would expect given each district's overall racial and ethnic composition.

There are two important exceptions. The first is D.C. proper, where, for example, only about 33 percent of the typical white student's peers are black, even in a district where almost three-quarters of the student population is black. Conversely, the typical D.C. black student attends a school in which about 5 percent of her peers are white, even though white student representation in the district as a whole is almost twice that percentage. This is indicative of the systematic sorting of students into schools by race and ethnicity within D.C.

The second exception is the D.C. metro area as a whole, where isolation indexes (on the diagonal of the D.C metro area panel in Table 2) are notably higher than the overall composition of the metro area presented in Table 1, and exposure indexes are generally lower, particularly when looking at the isolation and exposure of white and black students. For example, the average black student in the metro area attends a school in which 11.2 percent of her peers are white, even though 26.5 percent of the metro area's students are white.

Overall, then, students in all six D.C. metro area districts attend schools in which peers of their own race or ethnicity are overrepresented and, in most cases, peers of other races and ethnicities are underrepresented, although the magnitudes of these differences are generally only consistently large in D.C. proper and, particularly in the case of white|black exposure and isolation, in the D.C. metro area as a whole.

Interpreting the figures in Table 2 also shows that comparing isolation and exposure indexes between districts is complicated by the fact that these districts differ in their racial and ethnic compositions. For example, the white isolation index is highest in Arlington not necessarily because of segregation per se within the district, but mostly because Arlington serves a larger proportion of white students than any other district in the metro area. This indicates the need for alternative measures that account for the spread of students across schools in a manner that is independent of composition. It also suggests that students are sorted by race and ethnicity between districts. We address both of these issues below.

Evenness (IT index)

To reiterate, the IT index focuses on the dispersion of students across schools regardless of composition. It is expressed in terms of how much, on average, schools deviate from unitwide (districtwide or metro areawide) diversity.

Note that the conceptualization of segregation and integration embedded in the IT index, unlike that implied by exposure/isolation, is relative—i.e., schools are integrated to the extent their students resemble the racial and ethnic composition of the "unit" overall (with the unit being either the district or the metro area). This is often an issue when measuring segregation within a single non-diverse jurisdiction. For example, relying solely on the IT index or other "evenness" measures, an overwhelmingly African American district might be considered integrated even though all of its schools are over 95 percent African American (so long as students are distributed evenly across schools by race and ethnicity). This is why we rely on multiple measures in this analysis. Moreover, given that our primary focus is on a metro area that is indeed racially and ethnically diverse, and that the districts

comprising that metro area are at least modestly diverse (albeit to varying degrees), this is less of a potential issue for our present purposes.

That said, Table 3 presents the IT index values for multiple race and ethnicity comparisons, for the D.C. metro area overall as well as by district.

TABLE 3

Information theory segregation index, by race and ethnicity comparison and district, D.C. metro area schools, 2015-16

	Alexandria City	Arlington	D.C.	Fairfax	Montgomery	Prince George's	TOTAL METRO
White|Black	.143	.184	.556	.170	.265	.193	.507
White|Hispanic	.120	.215	.470	.196	.262	.289	.309
White|Asian	.149	.076	.184	.088	.110	.125	.115
Black|Hispanic	.075	.063	.420	.086	.081	.296	.303
Black|Asian	.031	.060	.387	.182	.167	.138	.445
Hispanic|Asian	.046	.105	.269	.185	.194	.201	.259
White|Minority	.109	.169	.465	.111	.185	.161	.282
White|Black|Hispanic	.093	.165	.448	.152	.183	.267	.341
Black|Hispanic|Asian	.062	.071	.403	.139	.122	.262	.306
Multiracial	.084	.128	.428	.124	.151	.242	.296

Notes: White|Minority comparison aggregates categories of black, Hispanic and Asian ($H_{W|BHA}$), whereas multiracial ($H_{W|B|H|A}$) comparison includes each group separately. Excludes students coded as "American Indian/Alaska Native," "Hawaiian Native/Pacific Islander" or "Two or more races." D.C. metro area defined as noted in table.

For example, the first column of the first row shows that white|black segregation in Alexandria City is 0.143, which means that, looking only at black and white students, the "amount of diversity" in the typical Arlington school is 14.3 percent lower than it is for Arlington students as a whole. If, hypothetically, all Arlington schools were the same in terms of their students' racial and ethnic diversity (in this case defined solely in terms of white and black students), the index would be zero, indicating perfect integration.

As a rough rule of thumb, IT index values between 0.20-0.40 might be interpreted as reflecting moderate segregation, and values above 0.40 can be interpreted as high segregation. By this standard, most of our six districts exhibit relatively moderate segregation. The separation of white from minority students is generally more pronounced than the separation of minority groups from each other. Interestingly, while white|black segregation is often higher than that of other racial and ethnic combinations, this is not always the case in the districts of the D.C. metro area. The IT indexes measuring white|Hispanic segregation are similar to the white|black estimates in all districts except D.C. proper, and the former is actually higher in three districts.

Looking at the final row of Table 3, which measures segregation of all four groups simultaneously ("multiracial" segregation), we find very low IT index values in Alexandria, low-to-moderate segregation in Arlington, Fairfax and Montgomery, and moderate segregation in PGC. Once again,

D.C. proper stands out, with high IT index values for virtually all racial and ethnic combinations except white|Asian.

Yet, once again, we still find some evidence of moderate and even high segregation for the D.C. metro area *as a whole* (the rightmost column of Table 3). Most notably, looking at only the segregation of white and black students, the typical school is over 50 percent (50.7) less diverse than the metro area as a whole, and 44.5 percent in the case of Asian and black students. The areawide multiracial IT index (the bottom rightmost figure in the table) shows that, when looking at the segregation of all four races and ethnicities separately, the typical school is almost 30 percent (29.6) less diverse than the metro area overall.

Interestingly, Table 3 also suggests that minority students are moderately segregated from each other. For example, the black|Hispanic IT index is 0.303 across the entire metro area. The "traditional" notion of segregation, which is the separation of white from minority students, is increasingly accompanied by the segregation of minority students from each other (Reardon et al. 2000). It follows that the integration of minorities, both within and between districts, can also attenuate total multiracial segregation (we do not address this here, but see Di Carlo and Wysienska-Di Carlo's [2017] analysis of D.C. proper).

As was the case with Table 2, then, we find rather modest segregation in most of the D.C. metro area's districts (all but D.C. proper), but moderate-to-high segregation in the metro area as a whole, particularly when it comes to black and white students. This might raise the question: How can the metro area's segregation be higher than that of all its constituent districts except D.C. proper, which serves a student population that is relatively small compared to the metro area as a whole?

The answer, as discussed briefly above, is that total metro area segregation consists of two components: 1) segregation *within* districts, and 2) segregation *between* districts. We turn now to the decomposition of within- and between-district segregation.

Within-district/between-district decomposition

One of the very useful features of the IT index is that it can be broken down into within- and between-unit components. In our context, total metro areawide segregation is a function of segregation within each of our six districts, as well as segregation between them.

Both segregation within districts and that between districts can hinder the achievement of integration, which we define analytically as a situation in which every single school has the same racial and ethnic composition as the metro area as a whole (in the case of four-category "multiracial" segregation, this means, per Table 1, that every single school in the metro area would be roughly 27 percent white, 35 percent black, 27 percent Hispanic and 12 percent Asian).

Integrating schools *within* each district—essentially, shuffling students such that every school has the same composition as the district in which it is located—will usually go a long way toward achieving metro areawide integration. If, however, there is a compositional imbalance between districts (e.g., one

or two districts serve a disproportionate number of white students), achieving the metro areawide totals would be impossible.

For example, perfect multiracial integration of D.C. proper—that is, *within*-district integration—would require that all D.C. schools match the districtwide racial and ethnic composition presented in Table 1, which is roughly 10 percent white, 72 percent black, 16 percent Hispanic and 2 percent Asian. This would be an enormous accomplishment. D.C. is generally the most internally segregated district in our analysis, and integrating its schools would therefore make a large *within*-district contribution to overall integration of the metro area.

Even if it were integrated internally, however, it would still be impossible for D.C. schools to match the racial and ethnic composition of the *metro area* as a whole (27, 35, 27 and 12 percent). This is because D.C.'s students are, relative to the metro area as whole, disproportionately black, and the District does not serve a sufficient number of students of other races and ethnicities to achieve the metro areawide proportions in each of its schools. The degree to which this discrepancy in the racial and ethnic makeup between each district and the metro area overall makes it impossible for schools to match the areawide makeup is a useful way to think about *between*-district segregation. The more different each district is from the metro area averages, the more it contributes to total segregation via between-district segregation, all else being equal.

This discrepancy, of course, is larger in some districts than others. For example, the racial and ethnic makeup of students in Alexandria and Montgomery is far more similar to that of the overall metro area than is the case in D.C. or PGC. This means that perfect integration *within* Alexandria and Montgomery would not result in a situation in which all schools in each district perfectly matched areawide composition, but it would come fairly close, or at least far closer than would perfect integration within D.C. and PGC.

In this sense, D.C. and PGC, all else being equal, are more important "sources" of between-district segregation, and thus larger obstacles to areawide integration than Montgomery or Alexandria, because students in D.C. and PGC are more different than the metro area as a whole.

In short, between-district segregation measures the degree to which total metro areawide integration would require the shuffling of students *between* districts. And the IT index allows us to quantify how much each district's internal segregation contributes to metro areawide segregation, as well as the contribution of segregation *between* the districts.

Table 4 presents the decomposition of metro areawide segregation (row 1, identical to the metro areawide estimates presented in Table 3) into: 1) total within-district segregation (row 2), 2) within-district segregation within each of our six districts (rows 3-8), and 3) total between-district segregation (row 9). Note that the sum of rows 3-8, which are within-district segregation contributions of each district, is equivalent to row 2, which is the contribution of total within-district segregation. Also, the sum of row 2 and row 9 equals row 1— that is, the contribution of total within-district and between-district segregation is equivalent to total metro areawide segregation.

We also decompose the between-district component into two subcomponents: 1) segregation between D.C. and the suburbs (row 10), and 2) segregation between suburbs (row 11). Note that rows 10 and 11 sum to row 9.

TABLE 4

Decomposition of segregation (IT) index, by race and ethnicity comparison, D.C. metro area schools, 2015-16

		White | Black $H_{W\|B}$		White | Minority $H_{W\|BHA}$		White | Black | Hispanic $H_{W\|B\|H}$		Multiracial $H_{W\|B\|H\|A}$	
	Component	**H**	**%**	**H**	**%**	**H**	**%**	**H**	**%**
(1)	Total metro area	.507	100.0	.282	100.0	.341	100.0	.296	100.0
(2)	Total within district	.179	35.4	.153	54.4	.188	55.2	.158	53.4
(3)	*Within Alexandria*	.003	0.7	.003	1.0	.003	0.7	.002	0.7
(4)	*Within Arlington*	.005	1.1	.008	3.0	.006	1.8	.005	1.6
(5)	*Within D.C.*	.059	11.7	.038	13.6	.050	14.5	.038	12.9
(6)	*Within Fairfax*	.034	6.6	.040	14.3	.038	11.0	.037	12.5
(7)	*Within Montgomery*	.061	12.0	.052	18.5	.046	13.4	.040	13.6
(8)	*Within PG*	.016	3.2	.011	3.9	.047	13.7	.036	12.2
(9)	Total between district	.328	64.6	.129	45.6	.153	44.8	.138	46.6
(10)	*Between city/suburbs*	.076	14.9	.022	7.9	.043	12.5	.040	13.6
(11)	*Between suburbs*	.252	49.7	.106	37.7	.110	32.3	.097	32.9

Notes: All percentages represent percent of total metro area segregation. Between city/suburbs subcomponent (row 10) is segregation between D.C. proper and suburbs. White|Minority comparison aggregates categories of black, Hispanic and Asian ($H_{W|BHA}$), whereas multiracial ($H_{W|B|H|A}$) comparison includes each group separately. Excludes students coded as "American Indian/Alaska Native," "Hawaiian Native/Pacific Islander" or "Two or more races." See the appendix for more details on the sample. Percentages may not sum to 100 due to rounding.

All percentages in Table 4 represent the proportion of total segregation (row 1) "contributed" by each component and subcomponent, by race and ethnicity comparison. They can also be interpreted as the amount by which total citywide segregation would be reduced if perfect integration was achieved within that district (or, in the case of row 9, between districts). For instance, eliminating white|black segregation within all six districts (row 2, first supercolumn)—i.e., reshuffling students such that every school in each district has the same percentage of white and black students as each district overall—would reduce metro areawide black|white segregation by 35.4 percent.

The contribution of within-district segregation in each district (rows 3-8) is a function of: 1) how segregated each district is internally, and 2) the district's size. Thus, for example, even though black|white segregation within Montgomery is drastically lower than it is in D.C. (see Table 3), the contribution of desegregating the former (12.0 percent) is slightly greater than that of desegregating the latter (11.7 percent). The reason is that Montgomery serves a much larger student population than does D.C. proper, and so integration has an outsized effect on areawide segregation vis-à-vis D.C. (see the Technical Appendix).

Table 4 indicates that a strikingly large proportion of total D.C. metro areawide segregation is found between districts. For example, 64.6 percent of black|white segregation is between districts, which means that even if black and white students were perfectly integrated within all six districts internally, almost two-thirds of total segregation would remain intact. Put differently, perfect intra-district integration of all six districts' white and black students, without movement of students between districts, would leave the metro areawide IT index at 0.328 (row 1 minus row 2 of Table 4). This would be a massive improvement, but it would not come close to anything resembling integration.

The contribution of between-district segregation is lower, but still large, in the case of multiracial segregation (the final supercolumn of Table 4)—between-district segregation accounts for almost one-half of total multiracial segregation (46.6 percent). Similar results apply to the white|minority comparison (this is a comparison of two categories, with black, Hispanic and Asian combined into a single group), as well as the white|black|Hispanic comparison (all three categories separately, with Asians excluded). Once again, perfect integration of each district without cross-district movement of students would make an enormous difference in metro areawide segregation, but it would, in essence, leave roughly half the problem untouched.

Finally, we might quickly review the decomposition of between-district segregation into its central city|suburb (row 10) and between-suburb (row 11) subcomponents. The former represents segregation of students between D.C. proper (the central city) and the five suburbs in our analysis (essentially treating the five suburbs as one big district, and comparing the racial and ethnic breakdown of students between the District and this suburban bloc). The latter represents segregation between the five suburbs, without reference to D.C. The sum of these two subcomponents is equivalent to total between-district segregation (row 9).

Reardon et al. (2000) show that, nationally, segregation between central cities and suburbs is by far the larger contributor of the two subcomponents, at least during the 1990s. Our results indicate that the opposite situation is found in the D.C. metro area. In all four race and ethnicity comparisons, the contribution of city-suburb segregation is far smaller than that of segregation between suburbs.

For example, looking at the multiracial comparison (rows 10 and 11 in the final supercolumn of Table 4), we see that fully integrating D.C. with the suburbs, which means shifting students between D.C. and the suburbs such that both sectors exhibited the same student racial and ethnic breakdown) would reduce total metro area segregation by 13.6 percent. Integrating the five suburbs (i.e., shifting students between suburbs such that all five exhibited the same racial and ethnic composition as the suburbs overall, and leaving D.C. as is) would reduce total segregation by 32.9 percent. The difference is even more pronounced for the other three comparisons—e.g., for the white|black comparison, the between-suburb subcomponent is over three times larger than the city|suburb subcomponent.

This is due in large part to the stark differences between suburbs in the racial and ethnic composition of their students (see Table 1). For instance, PGC serves roughly one-quarter of suburban students, but almost 60 percent of suburban black students.

These results suggest that moving students between D.C. proper and the surrounding suburbs would certainly make a large dent in overall metro area segregation, but that a larger impact would be realized by shifting students between the suburbs themselves. In this sense, at least, it is highly misleading to view D.C. metro area segregation as a "city versus suburb" phenomenon. Much of the potential for integration is actually between the suburbs.

Conclusion

If we conceptualize student diversity as a resource, then the D.C. metro area is a case in which that resource is available in abundance, with substantial representation of white, black, Hispanic and Asian students. From this perspective, there is a potential for the area's schools to be truly multiracially and multiethnically diverse.

And, indeed, our results show that segregation is generally low to moderate *within* five of the six districts we include as part of the D.C. metro area, with the exception being D.C. proper. That is, the typical school in each of these five districts is only modestly less diverse than the district as a whole. Moreover, in four of these five districts (the exception being Prince George's County), the average student of each race or ethnicity has significant opportunity for interaction with students of the three other races and ethnicities included in this analysis.

Yet, *in the metro area as a whole*, we find at least moderate multiracial segregation (white|black|Hispanic|Asian), and extensive segregation of white and Asian from black students. The reason for this discrepancy—that is, the relatively modest segregation in five of our six metro area districts but moderate and even high segregation in the metro area as a whole—is the prominent contribution of between-district segregation to total segregation in the D.C. metro area. For example, roughly half of multiracial segregation, and two-thirds of black|white segregation, is due to the sorting of students *into districts,* rather than schools within districts.

In other words, differences between districts in the racial and ethnic composition of their students are stark enough that, even if all six districts were integrated internally (which would be a truly miraculous achievement), half of total metro areawide multiracial segregation, and two-thirds of black|white segregation, would persist. This essentially means that perfect integration, which we define analytically as a situation in which every school in the metro area has the same racial and ethnic makeup as the metro area as a whole, is, at best, half possible without substantial movement of students between districts.

Our findings overall illustrate the importance of measuring, discussing and, most importantly, addressing school segregation in a manner that includes consideration of both within- and between-district segregation. The "black cities, white suburbs" characterization has long been misleading, not only because of the increasingly multiracial and multiethnic population in the United States, but also because minorities are strongly represented in the suburbs of many (if not most) major metropolitan areas. In fact, we find that segregation between suburbs is a much larger contributor to total metro area segregation than segregation between the city (D.C.) and the suburbs. That is, desegregating the

suburbs would go further toward total metro areawide integration than desegregating the city with the suburbs.

Yet this characterization does offer a kernel of truth, which is that schools in many major cities do serve predominantly minority student populations, and a great deal of the "action" when it comes to segregation, and the potential for desegregation, is across the boundaries of districts surrounding those cities. For instance, integrating a district that is 95 percent black, Hispanic or white will have a limited impact on the opportunity of students to attend schools with significant groups of peers that don't "look like they do."

Unfortunately, virtually all efforts to desegregate schools, whether voluntary or court-ordered, have occurred within rather than between districts. The reasons for this are both legal (e.g., a 1974 Supreme Court decision that districts were not responsible for segregation across their borders unless such segregation was the deliberate intent of the drawing of those borders) and practical (e.g., attending schools across district lines would in many cases require long travel times, which is particularly problematic for younger students).

Neither the relatively encouraging results within five of our six districts, nor the difficulties in achieving between-district integration, should in any way hinder efforts to integrate schools within each of these districts. Indeed, doing so would represent a massive improvement in D.C. metro area segregation. But between-district segregation represents an "invisible ceiling" on integration efforts, one that is too often ignored or underemphasized.

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Technical Appendix

Sample

Students coded as "American Indian/Alaska Native," "Hawaiian Native/Pacific Islander" and "Two or more races" are eliminated entirely from the analysis, due to the low frequencies of these students. Students in these three categories amounted to roughly 4 percent of our original sample.

In addition, our original dataset included 66 schools for which there were no race and ethnicity frequencies. Most of them are classified as vocational, special education or alternative schools. These schools are excluded from our analysis.

Analysis

Using the example of the exposure of white students to black students, the **Exposure index** (*EXP*) can be expressed as

$$EXP = \sum_{i=1}^{n} \left(\frac{b_i}{B}\right)\left(\frac{w_i}{t_i}\right)$$

where b and w represent the number of black and white students, respectively, in each school i, B is the number of black students across the entire metro area or district, and t is the total number of students at the school. Exposure index values are presented in Table 2.

Theil's information theory index (*H*) operationalizes diversity in terms of entropy, which attains a maximum value when all groups (in our case, all four race and ethnicity categories) are equally represented in the student population, and a minimum value when the entire student population is comprised of a single group. Entropy is calculated across the entire unit (E) (district or metro area) and for each individual school (E_i). H is a weighted average of the deviation of schools' diversity from unitwide diversity. H can be expressed as:

$$H = \sum_{i=1}^{n} \left[\frac{t_i(E - E_i)}{ET}\right]$$

where t_i is the number of students at school i, and T represents the size of the student population across the entire unit. In a unit where every school exhibits precisely the same level of diversity as the district as a whole ($[E - E_i]=0$ for all values of i), H takes on a maximum value of one, indicating perfect integration (*within* the unit). IT index values are presented in Table 3.

Decomposition of H. The decompositions of H are from Reardon et al. (2000). Metro areawide H in the equation below is constituted by two different components. The first (H_D) is segregation between districts. The second is the weighted average of segregation within each district (H_d), weighted by both the district's relative size (T_d/T) and its relative diversity or entropy (E_d/E).

$$H = H_D + \sum_{d=1}^{k} \frac{T_d E_d}{TE} H_d$$

We can also further decompose the between-district component (H_D) into subcomponents: 1) between city and suburbs, and 2) between suburbs. In the equation below, the term representing within-district segregation (the third term) remains the same as above, since our central city contains only one district. Between-district segregation (H_D), however, is decomposed into segregation between the city and suburbs (H_{CXS}), and segregation between suburbs (H_{SD}), with the latter weighted by the relative size (T_S/T) and entropy (E_S/E) of the suburbs overall.

$$H = H_{CXS} + \frac{T_S E_S}{TE} H_{SD} + \sum_{d=1}^{k} \frac{T_d E_d}{TE} H_d$$

All of these calculations are presented in Table 4.

About the Authors

Matthew Di Carlo

Matthew Di Carlo is a senior research fellow at the non-profit Albert Shanker Institute in Washington, D.C. His current research focuses on education policy, including school segregation, school finance, value-added, school accountability, charter schools, and teacher compensation. His other projects include research on cross-national political attitudes, work and occupations, and social stratification/inequality. Matt has a B.A. from Fordham University, and a Ph.D. in sociology from Cornell University.

Bilan Jama

Bilan Jama served as a Fellow at the Albert Shanker Institute in Washington, D.C. She received an M.A. in Educational Transformation with a concentration in Advocacy & Policy from Georgetown University. She has a B.A. in International Studies from Virginia Tech. She was a 2015 corps member of Teach For America, and has worked as a science and social studies teacher in Houston, Texas. She has also worked as a Research Analyst for Fairfax County Government where she produced a hidden history project for the Neighborhood and Community Services department. The purpose of the project was to understand the role of public policy in contributing to racial disproportionalities of minority populations in Fairfax County, Virginia.

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555 New Jersey Ave, NW | Washington, DC 20001
Tel: 202.879.4401 | shankerinstitute.org