Subsidized Housing and School Segregation: Examining the Relationship between Federally Subsidized Affordable Housing and Racial and Economic Isolation in Schools

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Abstract: Each year, the federal government provides billions of dollars in support for low-income families in their acquisition of housing. In this analysis, we examine how several of these subsidized housing programs, public housing and Low Income Housing Tax Credit (LIHTC) financed housing, relate to patterns of school segregation for children. We use GIS to examine the location of subsidized housing vis-à-vis district boundaries and school attendance boundaries in four Texas counties. We then examine patterns of segregation between schools with and without subsidized housing in their attendance zones, as well as the extent of economic and racial isolation experienced by students in those schools. Our results illustrate that public housing and LIHTC housing developments are zoned to racially and economically isolated schools, and that developments are associated with especially high levels of economic and racial isolation for Black and Latinx students. We conclude by discussing implications for housing and education policy to ameliorate these patterns.
Keywords: segregation; education policy; educational equity; Geographic Information Systems

Vivienda subvencionada y segregación escolar: Examen de la relación entre la vivienda subvencionada por el gobierno federal y el aislamiento racial y económico en las escuelas

Resumen: Cada año, el gobierno federal proporciona miles de millones de dólares en apoyo a familias de bajos ingresos en la adquisición de viviendas. En este análisis, examinamos cómo varios de estos programas de vivienda subsidiada, vivienda pública y vivienda financiada con Low Income Housing Tax Credit (LIHTC) se relacionan con patrones de segregación escolar para niños. Usamos GIS para examinar la ubicación de las viviendas subsidiadas con respecto a los límites del distrito y los límites de asistencia escolar en cuatro condados de Texas. Luego examinamos los patrones de segregación entre escuelas con y sin vivienda subsidiada en sus zonas de asistencia, así como el grado de aislamiento económico y racial experimentado por los estudiantes en esas escuelas. Nuestros resultados ilustran que los desarrollos de vivienda pública y LIHTC están divididos en zonas para escuelas aisladas racial y económicamente, y que los desarrollos están asociados con niveles especialmente altos de aislamiento económico y racial para estudiantes negros y latinos. Concluimos discutiendo las implicaciones para la política de vivienda y educación para mejorar estos patrones.
Palabras-clave: segregación; política educativa; equidad educativa; sistemas de información geográfica

Habitação subsidiada e segregação escolar: Examinando a relação entre habitação subsidiada pelo governo federal e o isolamento racial e econômico nas escolas

Resumo: A cada ano, o governo federal fornece bilhões de dólares para apoiar famílias de baixa renda na compra de casas. Nesta análise, examinamos como vários desses programas por habitação subsidiada, habitação pública e Low Income Housing Tax Credit (LIHTC) se relacionam com os padrões de segregação escolar para crianças. Usamos o GIS para examinar a localização de moradias subsidiadas em relação aos limites distritais e de frequência escolar em quatro condados do Texas. Em seguida, examinamos os padrões de segregação entre escolas com e sem moradia subsidiada em suas zonas de atendimento, bem como o grau de isolamento econômico e racial experimentado pelos alunos dessas escolas. Nossos resultados ilustram que LIHTC e empreendimentos de habitação pública são divididos em zonas para escolas racial e economicamente isoladas, e que os

desenvolvimentos estão associados a níveis especialmente altos de isolamento racial e econômico para estudantes negros e latinos. Concluímos discutindo as implicações para a política de habitação e educação para melhorar esses padrões.
Palavras-chave: segregação; política educacional; equidade educacional; Sistemas de Informação Geográfica

Subsidized Housing and School Segregation:
Examining the Relationship between Federally Subsidized Affordable Housing and Racial and Economic Isolation in Schools

Since the mid-20th century, the federal government has provided billions of dollars to support low-income families in their acquisition of housing. These supports have been provided through a variety of programs, including public housing, housing vouchers, as well as tax subsidies (Congressional Budget Office, 2015, p.1).[1] Although they are not an official part of education policy, these federal housing supports have an influence on the educational experiences of low-income children. This is because, despite the expansion of school choice policies, public school assignment is still overwhelmingly determined by students' geographic residence. In 2016, 78% of public-school students attended their local, assigned, public school, while 22% attended a public school of choice (National Center for Education Statistics [NCES], 2019).

This enduring relationship between geographic residence and school assignment means that the federal housing subsidies that shape where children live are an important, albeit less recognized, part of federal educational policy. Yet, despite the close relationship, few studies have examined how federal housing supports provided to low income families relate to educational access and opportunity for low-income children.

This study seeks to fill this gap by examining how federal housing supports for low income families relate to one key marker of opportunity: school segregation. School segregation is an important indicator of educational equity, as schools that are segregated by race and class have been shown to systematically face institutional barriers that depress student achievement, such as a lack of qualified teachers, inequities in resources, and higher rates of teacher and leadership turnover (US Government Accountability Office [GAO], 2016). Attendance at such schools, research has found, is negatively associated with student achievement (Reardon et al., 2019), and has negative consequences on college attendance and earnings over the long run, for students of all racial and ethnic backgrounds (Johnson & Nazaryan, 2019).

In this analysis, we examine how federally-subsidized housing for low-income families relates to patterns of school segregation experienced by children in those families. We focus on two types of subsidized housing: public housing and Low Income Housing Tax Credit (LIHTC) financed housing. We look first at the geographic dispersion of subsidized housing, examining the characteristics of school districts that subsidized housing developments are located within. We then look at the location of subsidized housing developments within school districts, examining the schools that developments are zoned to, paying close attention to patterns of segregation by race

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[1] It should be noted that the majority of federal housing support has gone to upper income families: in 2014, the federal government provided $140 billion in support for middle class and upper income families for home purchases through the mortgage interest deduction and property tax deductions (Congressional Budget Office, 2015, p. 1). That same year, the federal government also provided $50 billion in funding for lower income families through federal housing support programs (CBO, 2015, p. 1).

and poverty. Finally, we examine the segregation experienced by students of different racial and economic backgrounds in those schools.

Our research questions are:

1. What is the distribution of subsidized housing types between and within districts?

2. What is the level of segregation by race and poverty in schools that subsidized housing developments (LIHTC and public housing) are zoned to?

3. How does students' racial and economic exposure differ by presence and type of subsidized housing property, and by level of schooling (elementary, middle, and high?)

To answer these questions, our analysis includes data on housing and schools from four Texas counties covering Dallas, Houston, Austin, and San Antonio, which are collectively amongst the largest and most diverse in the nation.

Subsidized Affordable Housing Programs and Residential Segregation

The federal government's housing supports for low income families can be grouped into four broad categories: 1) public housing, which consists of apartment complexes owned and operated by the federal government, specifically for low-income families; 2) Housing Choice Vouchers (HCV) (formerly known as Section 8 Vouchers), which provide families with vouchers to help pay for housing on the private market; 3) privately owned subsidized housing, whereby the government contracts with private landlords to provide subsidized units in their developments (also known as Project Based Section 8); and 4) Low Income Housing Tax Credit (LIHTC) housing, which consists of federally subsidized apartment developments with rents set at affordable levels for at least 30 years.

In this analysis, we focus on two types of federally subsidized housing specifically: public housing, and LIHTC housing. One key reason that we focus on public housing and LIHTC housing is that, because they consist of federally owned or financed apartment complexes, the location of units geographically is more directly influenced by federal and state policy. The other two types of federal housing assistance more subject to the willingness of local landlords to participate (in the case of Housing Choice Vouchers) or continue to participate (in the case of Project Based Section 8 projects whose subsidies expire) and are thus relatively less directly influenced by policy.[2] Further, data for those latter two programs are not available at the local address level so we are unable to map where they are located vis-à-vis local schools.

Understanding how the location of federally subsidized affordable housing relates to school segregation requires understanding the political history of the programs themselves. We briefly detail the history of each program, below.

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[2] The one notable exception is the federal Moving to Opportunity experiment, carried out in the 1990s, which sought to influence where voucher recipients lived, thought it did not influence landlord practices.

Public Housing

Federally funded public housing was first authorized by the Wagner-Steagall Housing Act of 1937, which established local housing agencies that would, in turn, build local housing projects (Jackson, 1980, p. 446). This initiative was renewed and expanded by the 1949 Housing Act, which set a goal of building more than 800,000 units of public housing in 6 years, although the full number of units was not actually built for 20 years (McDonald, 2011).

For many decades, the public housing that was built intentionally reinforced patterns of residential racial segregation, as new all-black or all-white public housing projects were regularly constructed only in racially isolated neighborhoods (Rothstein, 2017). Segregation in public housing was then exacerbated by the federal Urban Renewal programs in the 1950s and 1960s, which razed housing in communities of color in the urban core and relocated those residents into high-rise, intensely segregated public housing projects in low income and segregated communities (Massey & Denton, 1993; Turner et al., 2009). By the 1980s, as a result of these discriminatory actions, public housing in major cities was occupied primarily by African Americans, and limited to the lowest income residents due to income restrictions. These developments were also, by and large, underfunded and poorly maintained. As Turner et al. (2009) observe: "by limiting occupancy to the poorest of the poor, these policies created even more severe concentrations of distress" (p.5).

In response to these growing evidence of the harms caused by racial isolation and poverty concentration, in the early 1990s, the federal government changed its strategy, tearing down public housing and replacing the demolished units with mixed income developments through the HOPE VI (Housing Opportunities for People Everywhere) program launched in 1992 (Popkin et al., 2004).[3] Over the next two decades, from 1993-2010, 262 grants altered the landscape of public housing (US Department of Housing and Urban Development (HUD), n.d.). Redevelopment was successful in improving living conditions within the developments themselves, and reducing poverty rates in neighborhoods surrounding the developments (Owens, 2015).

However, evidence shows Hope VI has not changed overall patterns of segregation, particularly for displaced residents, and that the program has, in some contexts, spurred gentrification and displacement of low-income residents nearby (Popkin et al., 2004). Indeed, research has found that the renovated Hope VI units are still are located in neighborhoods with high proportions of low-income residents and residents of color (Schwartz et al., 2010, p. 69; Owens, 2015). As a result, the developments often reinforce patterns of racial segregation and limited mobility for families, particularly families of color (Drier et al., 2014). Moreover, there was a net loss of over 43,000 public housing units as a result of the redevelopment through HOPE VI (Gress et al., 2016, p. 14).

The problems with, and expense of, public housing led Congress to enact and expand programs in the 1970s and 1980s that were aimed providing more affordable housing on the private market. These programs included the Section 8 New Construction and Section 8 Rehabilitation programs, through which private owners and developers entered into long term monthly payment contracts with HUD, and the Housing Choice Voucher Program (formerly known as the Section 8 voucher program), which provides vouchers to individuals to find rental housing on the private

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[3]Originally passed in October 1992 through the Departments of Veterans Affairs and Housing and Urban Development, and Independent Agencies Appropriations Act, 1993. The purpose was to address distressed and neglected public housing using a three-prong approach: by making physical improvements, providing maintenance funds for improvements, and to provide services that addressed the residents and their communities' needs HUD, n.d.). In 2000, the program was added as Section 24 of the U.S. Housing Act. This allowed grants to be issued through HUD as part of their funding.

market (Congressional Research Service, 2014; Schwartz, 2010). Research has found largely that Section 8/HCV programs also, like public housing, reinforce patterns of segregation in large part because "…low income renters still face a shortage of affordable apartments in the suburbs and landlord resistance to the program" (Drier et al., 2014, p. 143; DeLuca et al., 2019).

The Low Income Housing Tax Credit Program

Congress' focus on incentivizing the production of affordable housing on the private market was also exemplified by the creation of the Low Income Housing Tax Credit program, authorized by the Tax Reform Act of 1986 (Gramlich, 2015; Roisman, 1998). The LIHTC program was designed to promote the private construction of affordable housing by providing tax credits to developers (Owens, 2015). Under the LIHTC program, each state is given an allocated value of tax credits based on overall population; states then allocate the credits to developers or investors, who sell the credits to provide capital which is then used to build affordable housing. Investors are incentivized to purchase the tax credits because they can benefit in a number of ways, including: a) reducing their tax obligation through the credit, which can be claimed over a period of 10 years; b) claiming a tax deduction on the depreciation of the property and operating losses; and c) earning a return on the investment in the project itself (Scally et al., 2018). Developers apply for credits to the state and credits are awarded based on state Qualified Allocation Plans (QAPs).[4] Each development must set-aside a proportion of units that will be affordable to lower income families who qualify: developers must either set aside at least 20% of (and restrict rent for) units for households that are at or below 50% of the Area Median Family Income (AMI), or set aside 40% of units for households at or below 60% of AMI (Gramlich, 2015). The rent restrictions are tied to particular units, and therefore, if a low-income resident lives in a subsidized unit, and his or her income increases, their rent will not change.

The LIHTC program has been considered a success in prompting the construction of more affordable housing. Abt Associates (2012) estimated that in the first two decades of the program's operation, approximately one-third of all new multifamily rental housing units were constructed with financing from the LIHTC program. In 2014, the LIHTC program had a cost in foregone revenue of $8 billion, making it the largest federal expenditure for creating affordable rental units (US GAO, 2015, p.1).

Yet, despite the program's success in producing more affordable housing, it has been critiqued for a lack of oversight and accountability, particularly when it comes to questions of civil rights enforcement and fair housing principles (Muralidhara, 2006; Roisman, 1998; US GAO, 2015). Among all LIHTC properties funded between 1995 and 2006, a higher proportion of LIHTC units

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[4] Low Income Housing Tax Credit programs are categorized into two types: competitive and non-competitive, which are mainly determined by the amount of equity provided by the tax credit towards the costs of a low-income housing project (Office of the Comptroller of the Currency, 2014). Non-competitive LIHTCs are given a four percent tax credit through the program, equal to 30 percent of the present value of the project. If developers wish, they can receive bond funding through the state's multifamily bond programs when at least 50% of the project costs are funded by municipal or local bonds (Texas Department of Community and Housing Affairs, 2019). The competitive LIHTC have much more stringent requirements placed upon them in exchange for a nine percent tax credit, equal to 70 percent of the project value. The IRS allocates a limited number of 9% credits to the state annually, which are then scored and vetted through their Qualified Allocation Plan (QAP). The highest scoring projects are then awarded the 9% LIHTC. Each state's QAP is different, but includes stipulations on where LIHTC properties can be built, types of housing available and target populations (Scally et al, 2018). Because the 9% credits have a higher return on investment for developers, this allows the state to provide incentive to build LIHTC properties in areas where affordable housing is needed.

were built in higher poverty and higher minority census tracts compared to non-subsidized rental properties (Abt Associates, 2009; see also Abt Associates, 2007; Smith, 2016). Scholars have identified several reasons for this: first, state QAPs (the system for awarding credits) often deduct points for local opposition, which means that politically influential residents can keep developments out of higher income communities (Roisman, 1998; Rothstein, 2017). Second, state QAPs often award extra points for proposed projects that are located distressed communities as a way to revitalize such neighborhoods, thus reinforcing patterns of segregation (Scally et al., 2018). Third, land is often less expensive in racially isolated neighborhoods as a result of decades of discrimination and disinvestment in communities of color by federal, state and local governments, as well as redlining by banks and insurance companies (Rothstein, 2017). This land devaluation has provided another economic incentive for developers to locate or rehabilitate developments in segregated contexts (Rothstein, 2017; Scally et al., 2018; Smith, 2016).

In addition to critiques that the LIHTC program reinforces segregation, the program has been criticized for a lack of oversight by the IRS (GAO, 2015), and the program has also been critiqued for failure to collect meaningful data on the residents of LIHTC properties (Smith, 2016). As a result, some argue that the LIHTC program provides a significant financial benefit to corporations and developers, without assurances around fair housing or civil rights compliance (Smith, 2016).

The Role of Local Jurisdictions

While the LIHTC and federal public housing programs frequently result in the concentration of affordable housing in low-income communities and communities of color, local jurisdictions also play a significant role in concentrating affordable housing into those same communities (Tegeler, 1994). In many states, local support weighs heavily in the approval of LIHTC developments and public housing developments, and frequently, higher-income communities often do support them (Haberle & Tegeler, 2019; Tegeler, 1994). Further, many middle income and higher income jurisdictions exclude affordable housing from their communities through the use of exclusionary zoning, such as lot-size controls (i.e. minimum lot size requirements), and density controls (i.e. limiting multifamily housing) (Katz et al., 2003; Serkin & Wellington, 2013).

While school districts typically have little influence on the geographic placement of affordable housing properties, school districts do control which schools those properties are zoned to. These school attendance boundary decisions can fuel both school and residential segregation. For example, if a school district zones a subsidized housing property to a racially isolated and/or low-income school, these decisions can worsen not only school segregation, but also fuel segregation in neighborhoods around affordable housing properties, as white and middle-class families often seek to avoid housing near such schools (Holme, 2002; Lareau & Goyette, 2014; Liebowitz & Page, 2014).[5]

Subsidized Affordable Housing Programs and School Segregation

It is clear from our review of the history of the federal public housing and LIHTC programs that affordable housing programs, combined with policies enacted by local jurisdictions, frequently result in the concentration of affordable housing properties into low-income communities and

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[5] In recent years, higher income and predominately white communities have voted to secede from more racially diverse districts, worsening "between-district" segregation (Taylor et al., 2019). If these school district secessions cut off communities of color with disproportionate shares of affordable housing, they can result in the concentration of affordable housing into even more isolated school districts.

communities of color. As a result, families seeking affordable housing through these programs are often restricted to housing in racially and economically isolated neighborhoods.

Less is known, however, about the segregation levels in *schools* that the children in LIHTC financed housing and public housing are zoned to. This is an important question, given the documented links between school segregation and short and long-term educational outcomes. Research has long shown that racial and economic isolation in schools negatively affects student achievement (Reardon et al., 2019; Reardon & Owens, 2014). Most recently, Reardon et al.'s (2019) analysis of eight years of student test score data from all U.S. public schools found that racial disparities in student achievement were directly linked to racial segregation. The underlying reason for this gap, they found, was the economic segregation (specifically concentrated poverty) that occurs in isolated non-White schools.

Racial and economic integration in schools, by contrast, has been shown to have positive impacts on student outcomes, including improved high school graduation rates and rates of overall educational attainment (Johnson, 2011; Johnson & Nazaryan, 2019; Wells et al., 2016; Yun & Moreno, 2006). Further, school integration has been linked to improved earnings, lowered odds of poverty, and increased odds of working in White-collar occupations (Reardon & Owens, 2014). It important to acknowledge, however, that there are varied within-school experiences of students of color in predominately White school settings, which also affect educational opportunity for students of color in those schools (Lewis & Diamond, 2017). For example, structures like academic tracking often prevent students of color from accessing advanced classes in diverse school settings, and can preclude all students from having access to integrated classrooms even when schools are diverse (Lewis & Diamond, 2017; Oakes et al., 1997). Yet, when they do exist, integrated classrooms also have been shown to foster reduced racial prejudice, increases in cross-racial friendships, and improved critical thinking and problem-solving skills (Antonio et al., 2004; Mickelson et al., 2012).

Given the documented links between school segregation and short-and long-term outcomes for children, a focus on school segregation is important in understanding the relationship between subsidized housing and educational opportunity. Yet, there has been relatively little attention in the research literature to the school segregation experienced by children in federally subsidized housing developments. In fact, we were able to locate only a handful of studies that examined the relationship between public housing and school segregation. One study, conducted by Schwartz et al. (2010), focused on the racial and economic composition of elementary schools attended by students living in public housing in the New York City school district. Schwartz et al. (2010) found that public housing developments in the district were concentrated into a relatively small number of school catchment areas. Further, public housing developments were zoned to schools with higher levels of segregation: the typical school attended by a public housing student had higher concentrations of students eligible for free lunch, and Black and Latinx students.

Two separate national-level studies by Ingrid Gould Ellen and Keren Mertens Horn compared the demographic composition of schools near different types of subsidized housing (public housing, HCV, LIHTC, etc.; Ellen & Horn, 2012, 2018). They found that tenants in federally subsidized housing (regardless of type) lived near elementary schools with significantly higher poverty rates than the universe of all households and all renters (Ellen & Horn, 2012, 2018). They also found that public housing residents lived near the highest poverty schools of all subsidized housing types. The researchers did not have access to actual attendance zones, however, and thus were not able to determine which schools the developments were actually zoned to.

Our work builds upon these studies and fills several gaps in the research literature. First, our use of GIS allows us to examine the characteristics of the actual schools that students living in subsidized housing are zoned to, across multiple districts. Further, because we have attendance zone

data, we are able to analyze all three levels of schooling (elementary, middle, and high schools) in contrast to prior work which focused only on elementary schools. Second, our analysis is among the first to examine the issue of school racial *and* economic segregation across two types of subsidized housing: LIHTC and public housing. Our work thus permits an understanding about whether there are any differences in patterns by housing type, a particularly important question to explore given the distinctly different histories of these programs. Third, our analysis is unique in that we are able to map affordable housing properties in relationship to attendance boundaries across multiple urban and suburban school districts within one state. Our broader analysis is important given growing diversity in suburbs (Drier et al, 2014), and understanding how affordable housing is situated vis-à-vis districts in these contexts is critical to document.

Methodology

Data

This study draws on housing, geographic, and school data from several data sources including the U.S. Department of Housing and Urban Development, the U.S. Census Bureau - TIGER/Line, the US Census Bureau's American Community Survey, the National Center for Education Statistics (NCES), and the Texas Education Agency (TEA).

In order to obtain the location of public housing developments and the location of properties financed with the Low-Income Housing Tax Credit, we relied on two datasets from the U.S. Department of Housing and Urban Development from 2016 that identify the geographic coordinates of each across the country. We then used the U.S. Census Bureau's TIGER/Line files to get the precise county boundaries to identify districts within each of the four counties we studied (Texas Natural Resources Information System, 2015).

School district and attendance zone boundaries came from two separate sources. TEA has a dataset in 2015-16 that specified the geographic boundaries of school districts. We then used the NCES EDGE (Education Demographic and Geographic Estimates program) School Attendance Boundaries Survey, which collected school attendance zone boundaries from across the country (Geverdt, 2018). We separately selected elementary, middle, and high school attendance zone boundaries for the districts in our dataset.

To study school-level patterns of segregation, we use data on the enrollment of students and other school characteristics including geographic coordinates of the school's location from TEA. These data provided counts on the number of enrolled students overall as well as by race/ethnicity and for low-income students, who are labeled by TEA as "economically disadvantaged," defined as students eligible for free or reduced-price lunch or other public assistance.

Methods

Our study employs spatial analysis via Geographic Information Systems (GIS). Spatial analysis tools such as GIS are particularly useful in uncovering patterns of geographic inequality (Lubienski & Lee, 2017). In this case, it allows us to merge two otherwise siloed geographic datasets--location of subsidized housing, and location of educational boundaries—to examine school segregation. Our analysis allows us to not only visualize segregation patterns, but it enables us to spatially categorize schools so that we can then engage in an analysis of such patterns.

For our analysis, we selected four of the five largest counties in Texas, which cover many of the state's largest metropolitan areas: Harris (Houston); Travis (Austin); Dallas (Dallas); and Bexar (San Antonio) counties. We opted to use the county as the geographic focus of analysis, as opposed to Metropolitan Statistical Areas (MSAs), because the county is a relatively more conservative bounding geographically in understanding patterns of segregation. This is because school districts

that are within MSAs but outside the county boundary lines tend to have more White residents and fewer low-income residents, and these districts often lack subsidized housing, and to include these outer edge districts would lead to more extreme estimates of school segregation vis-à-vis subsidized housing.

The original dataset in the four counties included 2,473 schools. Because of the nature of our research questions, which focus on the schools that subsidized housing properties are zoned to, we eliminated schools that would not have a typical attendance zone boundary such as magnet schools, charter schools, alternative schools and early childhood centers. Our final dataset included 1,676 schools (see Table 1).

Table 1
Number and percentage of schools in sample by grade level and presence of subsidized federal housing

	None	Public Housing only	LIHTC only	Both	Total
Elementary	952 (81%)	25 (2%)	170 (14%)	27 (2%)	1174
Middle	197 (59%)	8 (2%)	104 (31%)	25 (7%)	334
High	77 (46%)	5 (3%)	70 (42%)	16 (10%)	168
Total	1226 (73%)	38 (2%)	344 (28%)	68 (4%)	1676

Source: Texas Education Agency, NCES EDGE, US Department of Housing and Urban Development (2015-2016).

GIS

We used GIS to map the spatial distribution of traditional public schools based on their grade type in 2015–2016 (i.e., elementary, middle, and high schools), Low-Income Housing Tax Credit (LIHTC) properties, and public housing developments across the four Texas counties. We eliminated LIHTC properties that were designated only for senior (elderly) populations in our data set. This process resulted in the creation of five separate GIS layers: elementary schools, middle schools, high schools, LIHTC properties, and public housing developments. For the base layers (i.e., background on which to overlay the schools and housing), we mapped county boundaries, school district boundaries and the school attendance zones for each elementary, middle, and high school. Because school district boundaries and county boundaries are not always equivalent, some districts extend beyond the county line. We therefore applied a decision rule that incorporated into a county all school districts that had their centroids located within the county line. The benefits of using a centroid approach is that it keeps school districts whole for the sake of analysis, and there are no assumptions made about the population distribution within the centroid--as opposed to methods of selection like areal interpolation where the population is assumed to be evenly distributed throughout a geography (Saporito et al., 2007).

We then determined whether each school's attendance boundary contained one of the

following: an LIHTC property, a public housing development, both housing types, or neither. We examined the spatial relationships by grade-type, re-running the analysis for middle schools and high schools, and repeated this process for each of the four counties.

Measuring School Segregation

To examine how the location of subsidized housing properties relate to patterns of school segregation, we looked at segregation at the school level, as well as the individual student level. We discuss each, in turn, below.

School Racial and Economic Concentration. We first wanted to understand whether and to what extent properties were zoned to schools that were highly economically and racially concentrated. These schools, as noted earlier, have been shown to be negatively associated with student achievement (Reardon et al., 2019). We thus categorized all schools using classifications set forth by the U.S. GAO in their 2016 report on school segregation (GAO, 2016). In their analysis, the GAO grouped schools into two categories to identify schools that were highly segregated by race and income: the first category was schools that were 75% Black and Hispanic and 75% low-income, which we label in our analysis *intensely isolated* schools*;* and their second category were schools that were 90% Black and Hispanic and 90% low-income, which we label in this paper *extremely isolated* schools. The GAO examined a range of data, and found that schools that were intensely and extremely isolated were associated with lower levels of educational opportunity, as measured by access to advanced coursework and patterns of student retention and suspension (GAO, 2016, p. ii).

For this part of our analysis, like the GAO, we group Black and Latinx students together. This is not only for the sake of parsimony, it is also because these groups are demographically the largest groups of people of color in the state, and they have historically experienced extreme marginalization and segregation the U.S. education system and especially in Texas (Valencia, 2000). Yet one drawback of such grouping is that it may mask the distinct experiences of each group vis-à-vis segregation patterns, and it may miss other dimensions of segregation (i.e. linguistic isolation).

We examine the distribution of segregated schools across attendance zones with and without varying types of subsidized housing. To ascertain whether our two categorical variables--segregated school or not; type of subsidized housing that is present--are independent (e.g., not related) or whether the relationship between them is statistically significant, we use a Pearson chi-square test.

Exposure Index. We then sought to examine the level of segregation experienced by individual students attending the schools that LIHTC properties and public housing properties were zoned to. We measured the isolation of different groups within schools using the exposure index, which is a measure that is particularly well-suited to examining school segregation because it identifies the exposure and isolation of different racial groups, giving insight into the potential for interracial contact which is central to school desegregation efforts (Orfield et al., 2014). The interaction and isolation P* indices are used in this study to describe the interracial contact at schools that are zoned for LIHTC housing and public housing, as well as for schools that are zoned for neither LIHTC housing nor public housing. We compare the exposure index in these different school contexts in order to understand if there are differences in school segregation as related to particular housing programs.

Interaction, which measures interracial exposure, is calculated using the following equation:

$$_x P_y^* = \sum_{i=1}^{n} [x_i / X][y_i / t_i]$$

(1)

Here x_i, y_i and t_i are the counts of members of different racial groups and comprise the total population of unit i. X represents the total population of group x (i.e. number of Latinx in the

school). To measure isolation, or to what extent racial groups are only exposed to one another, isolation is calculated as:

$$_x p_x^* = \sum_{i=1}^{n} [x_i / X][x_i / t_i] \quad (2)$$

The exposure index can be interpreted as describing the composition of a school for the typical student. For example, the interaction and isolation indices could indicate that the typical Latinx student in Texas attends a school that is 65% Latinx, 10% White, 20% Black, and 5% Asian. The exposure index is impacted by demographic changes over time and the overall demographic composition of the study area. Therefore, when interpreting the results of exposure, it is important to note the overall student population composition in school districts.

In our analysis, we focus on students' exposure to poverty (defined as the proportion of students deemed "economically disadvantaged" by the state), as well as four other categories: exposure to White students, to Black students, and to Latinx students. Within our analysis, we consider segregation experienced by Asian students as well, given that Asians have also consistently experienced marginalization (Iceland et al., 2014).

Limitations

As noted previously, our spatial analysis allows us to not only visualize segregation patterns, it also enables us to spatially categorize schools so that we can then engage in a descriptive analysis of differences in segregation between schools with and without subsidized housing in their zones. Our descriptive analysis cannot, however, be used to draw causal conclusions about the relationship between subsidized housing and school segregation. Yet, as Loeb et al. (2017) point out, descriptive work such as ours can be important in exploring "…socially important phenomena that have not previously been recognized" (p. i). Our work establishes, as we shall illustrate, important patterns around subsidized housing and school segregation that, we will argue, are in need of attention by policymakers. Further, our descriptive work provides a foundation for future causal work (Loeb et al., 2017; Lubienski & Lee, 2017): future studies can, for example, use our work to frame a study of the effects of living in different types of subsidized housing on student achievement, or to compare students living in subsidized housing who are zoned to different types of schools.

It is also important to note that we are not analyzing the characteristics of specific students who live in public housing or LIHTC housing. Indeed, data on residents of LIHTC developments is not consistently collected nor is it publicly reported. As noted previously this lack of data has been one area of criticism of the program (Scally et al., 2018). We also do not have data on the actual schools that individual students who live in either LIHTC or public housing properties attend. As a result, we cannot draw conclusions about the levels of school segregation experienced by students in subsidized housing per se, but we can draw conclusions about the segregation levels in schools that such properties are zoned to, and isolation of students who attend such schools. Further, our study is specific to Texas counties, and further study may be warranted to better understand how these patterns may play out in other states.

Findings

In the first stage of our analysis, we examined the distribution of subsidized housing across school districts within each of the four counties. In the second stage, we examined the levels of racial and economic concentration in schools that subsidized housing properties were zoned to. In

the third stage, we examined racial and economic segregation experienced by students in those schools.

Distribution of Subsidized Housing Across and Within School Districts

Our first step was to use GIS to map where subsidized housing was located vis-à-vis school district boundaries, in order to examine which types of districts (in terms of both geography and demographic composition) contained different type of developments. We found that most districts (78%) had some type of subsidized housing within their boundaries: just over half (53%) of all districts (containing 48% of students across the four counties) had only LIHTC developments within their borders; nearly one quarter of districts (24%, containing 46% of students) had both LIHTC and public housing developments; and one district had a public housing development only (2% of districts, containing 2% of students; see Table 2). Approximately one-fifth of districts (22%) had no subsidized housing within their borders at all, but these districts had relatively small enrollments, accounting for 3.7% of the counties' enrollment.

Table 2
School district demographics by presence of subsidized housing

	#	Total Enrollment	Econ. Disadv.	White	Black	Latinx	Asian
Total	51	1,746,926	65%	18%	16%	59%	5%
None	11	64,127	35%	42%	14%	31%	10%
Public Housing only	1	38,671	56%	29%	21%	40%	7%
LIHTC only	27	838,661	60%	20%	17%	54%	6%
Both Public Housing and LIHTC	12	805,467	72%	13%	16%	67%	3%

Source: Texas Education Agency, NCES EDGE, US Department of Housing and Urban Development (2015-2016).

Comparing demographics of these districts, we found that districts with at least one subsidized housing development had larger shares of Black, Latinx, and low-income students than districts without any developments. The enrollment of districts with both types of subsidized housing (LIHTC and public housing) in their boundaries has the highest share of Latinx and economically disadvantaged students. The one exception was in Harris County, where LIHTC developments were actually located in districts where the percentage of low-income students was slightly lower than districts without any subsidized housing developments.

When we mapped the spatial distribution of housing across districts, we found, consistent with our above demographic analysis, that subsidized housing developments were concentrated into relatively more economically isolated urban and inner-ring suburban school districts. For example, the map of properties in Dallas County (Figure 1) illustrates that LIHTC and public housing units are clustered in the urban core (Dallas ISD), while the outer ring suburban districts of Coppell and Sunnyvale have no subsidized housing and have relatively low levels of child poverty. Similarly, in

Travis County (Austin) (map not shown),[6] public housing and LIHTC developments are concentrated in the central city district (Austin ISD), and also the inner ring suburban districts of Pflugerville and Manor. In Harris County (Houston) (map not shown), the pattern is more mixed: several economically and racially diverse districts like Cypress-Fairbanks and Katy ISD both have several LIHTC properties within their boundaries. Our analysis also illustrates how several counties contain districts with few children in low-income households that are immediately adjacent to, or even embedded within, urban districts that have no subsidized housing at all: Alamo Heights in Bexar County (San Antonio) (Figure 2) and Highland Park (in Dallas, Figure 1).

Figure 1
Distribution of subsidized housing in Dallas County (Dallas) by elementary school zone

Source: US Census Bureau, 2012-2016 American Community Survey 5-year estimates; Texas Education Agency, NCES EDGE, US Department of Housing and Urban Development (2015-2016).

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[6] Maps are available from authors upon request.

Figure 2
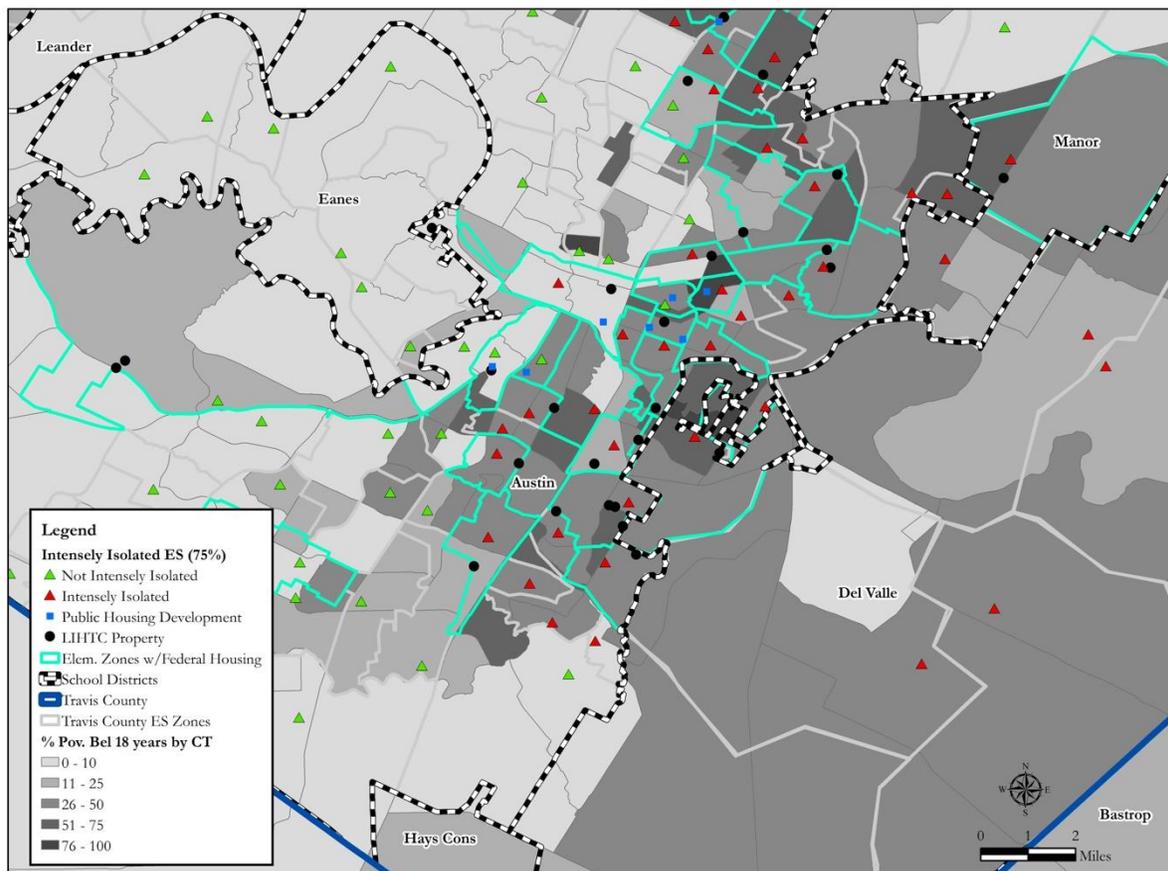Distribution of subsidized housing in Bexar County (San Antonio) by elementary school zone
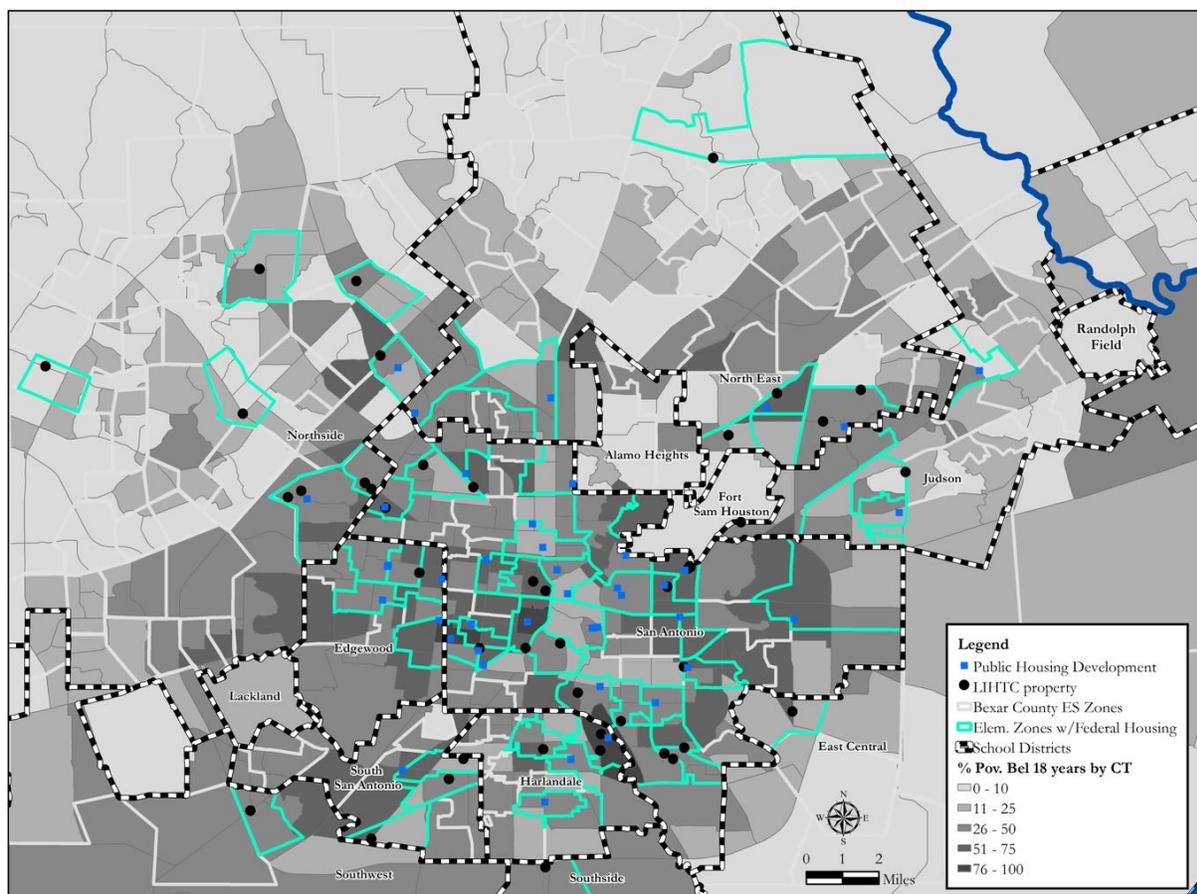
Source: US Census Bureau, 2012-2016 American Community Survey 5-year estimates; Texas Education Agency, NCES EDGE, US Department of Housing and Urban Development (2015-2016).

Not only is subsidized federal housing differentially distributed between districts, but, as our maps illustrate, within districts, housing developments are concentrated in the highest poverty neighborhoods. Also, in many instances the maps illustrate how the developments are often spatially clustered together, rather than distributed across different types of neighborhoods. For example, the map of Travis County (Austin) illustrates how the majority of properties are located in the Austin school district's historically segregated and predominately Black and Latinx eastern section, and in the highest poverty neighborhoods within the district.

Patterns of School Segregation in Relationship to Subsidized Housing Developments

For the next part of our analysis, we compare the segregation levels of schools with and without subsidized housing in their attendance zones. We then examine the level of segregation experienced by students in those schools.

School Racial and Economic Concentration

As noted previously, we followed the GAO Report (2016) to examine school-level patterns of segregation by race and class- e.g., schools with both high rates of poverty and high percentages of Black and Latinx students. We found that more than half (53.4%) of all schools in all four counties were intensely isolated (75% low-income and 75% Black and Latino). However, rates of intense isolation were much higher for schools with subsidized housing in their zones: 63% of schools with LIHTC developments, 68.4% of schools with public housing, and 79% of schools with both types of housing were intensely isolated (see Figure 3).

Figure 3
Percentage of schools with double segregation by type of subsidized housing in attendance zone in all four counties
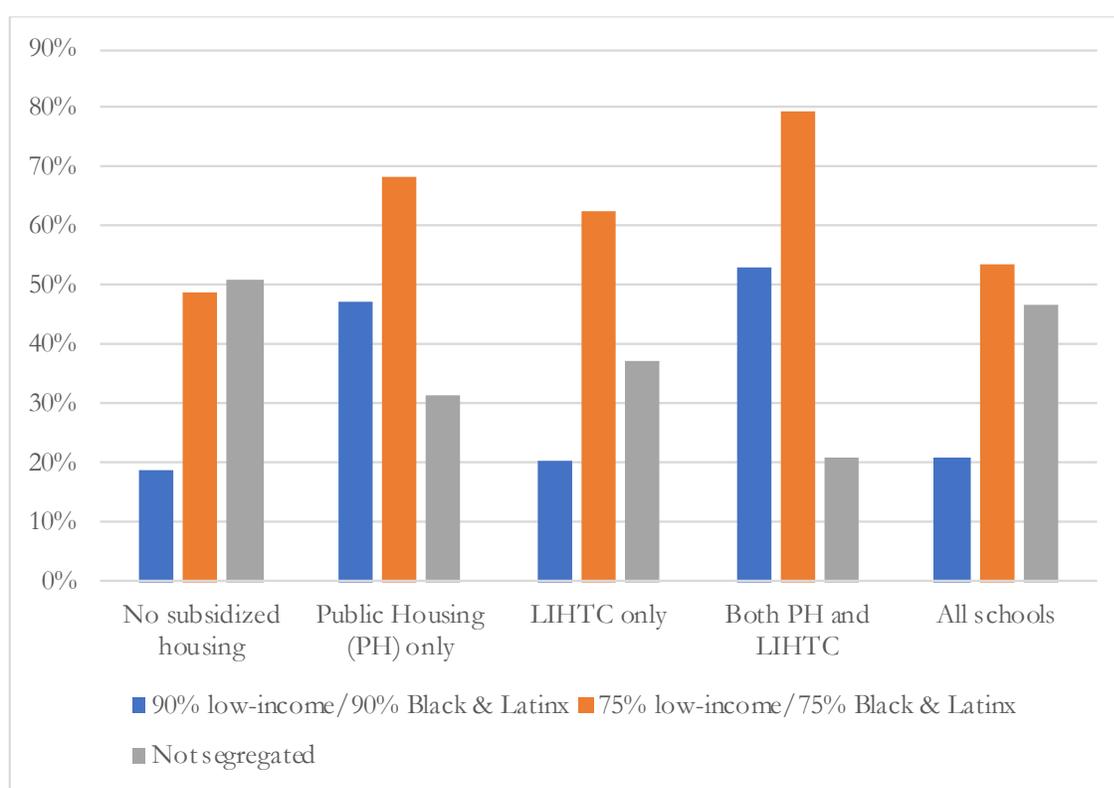
Source: Texas Education Agency, NCES EDGE, US Department of Housing and Urban Development (2015-2016).

Similarly, we found that one fifth (21%) of all schools were extremely isolated (90% low income and 90% Black and Latino enrollment) across the four counties. Again, rates of extreme isolation were much higher for schools with either just public housing in their attendance zones (47%), or both types of housing (LIHTC and public housing) in their attendance zones (53%). Schools with just LIHTC housing by contrast were not as likely to be extremely isolated. Chi-squared tests indicated for both categories that the differences between categories of subsidized housing type were statistically significant ($p<.01$).

We also explored segregation patterns by school level (elementary, middle, and high) and, at each level, schools with subsidized housing in their attendance zones were much more isolated than

schools without, and all at levels the disparities were statistically significant (see Appendix Table A-1). At each level of schooling, rates of intense and extreme isolation were also almost uniformly higher for schools that had both types of subsidized housing in their attendance zones. This clustering of housing occurred in 15% of schools (12% of elementary schools, 18% of middle and 18% of high schools) that had some type of subsidized housing in their zone.[7]

Our maps more clearly illustrate how developments are located in economically segregated neighborhoods, and zoned to highly segregated schools. For example, the map of Harris County (Figure 4) illustrates that developments are clustered into isolated areas in the urban core and also in isolated inner ring suburbs. Similarly, our map of San Antonio (not shown) illustrates that developments there are highly clustered into the urban core, where school segregation is especially high.

Figure 4
Harris County (Houston) distribution of subsidized housing by school isolation
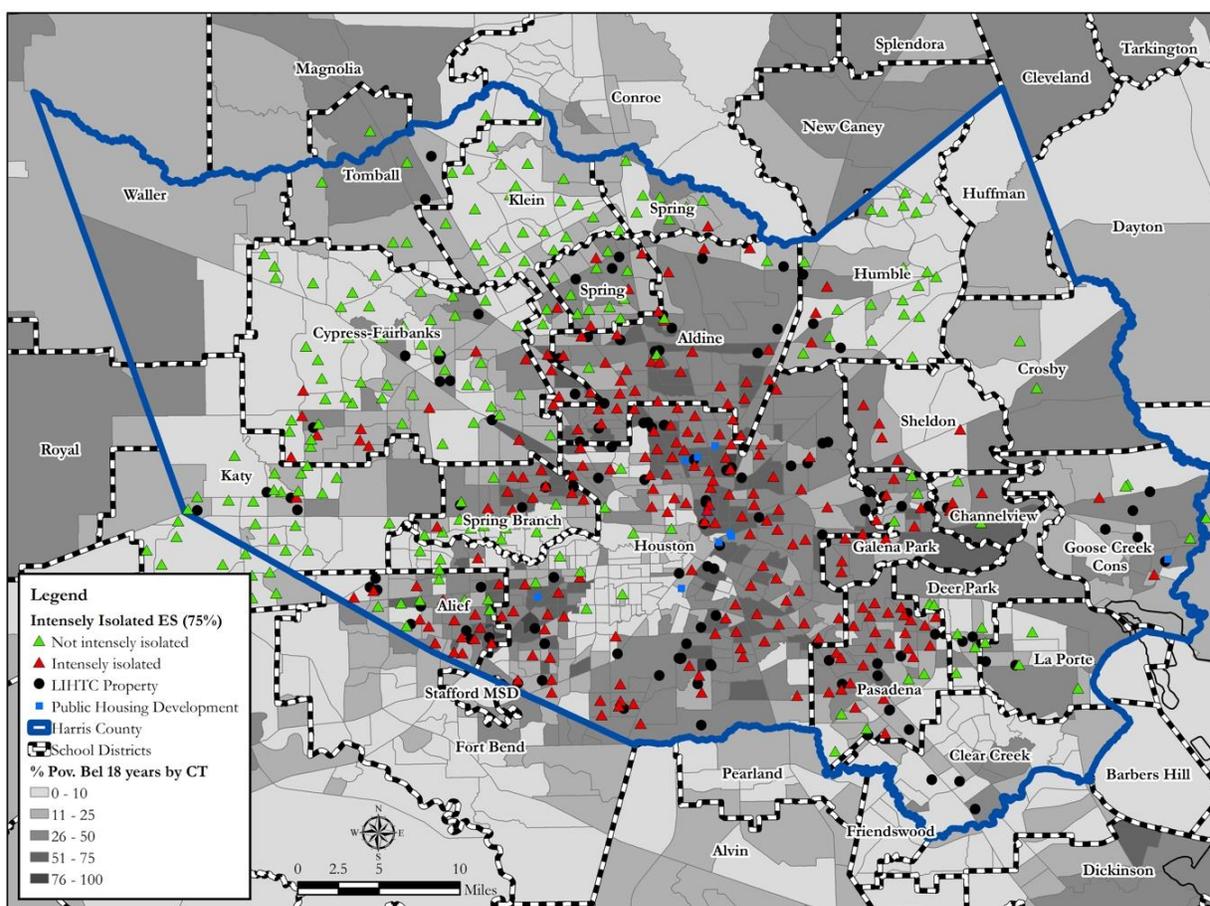
Source: US Census Bureau, 2012-2016 American Community Survey 5-year estimates; Texas Education Agency, NCES EDGE, US Department of Housing and Urban Development

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[7] It should be noted that our public housing only and LIHTC only categories may include more than one of those types of developments.

We also created several maps with a smaller scale that more clearly illustrate how districts cluster developments into attendance zones, rather than distributing them more broadly, and how that clustering is related to patterns of isolation that we found. For example, the map of Travis County that includes Austin (Figure 5) shows that many properties in Austin ISD are clustered into attendance zones of intensely isolated schools rather than distributed more evenly.

Figure 5
Travis County (Austin): Intensely Isolated Elementary Schools with Public Housing and LIHTC Properties

Source: US Census Bureau, 2012-2016 American Community Survey 5-year estimates; Texas Education Agency, NCES EDGE, US Department of Housing and Urban Development (2015-2016).

Further, the map of Dallas (Figure 6) illustrates how, in some racially diverse suburban districts, subsidized housing properties are zoned to intensely isolated schools even in more racially diverse school districts where more integrative zoning may be possible (such as Garland and Mesquite ISDs).

Figure 6

Dallas County (Dallas): Intensely Isolated Elementary Schools with Public Housing and LIHTC Properties
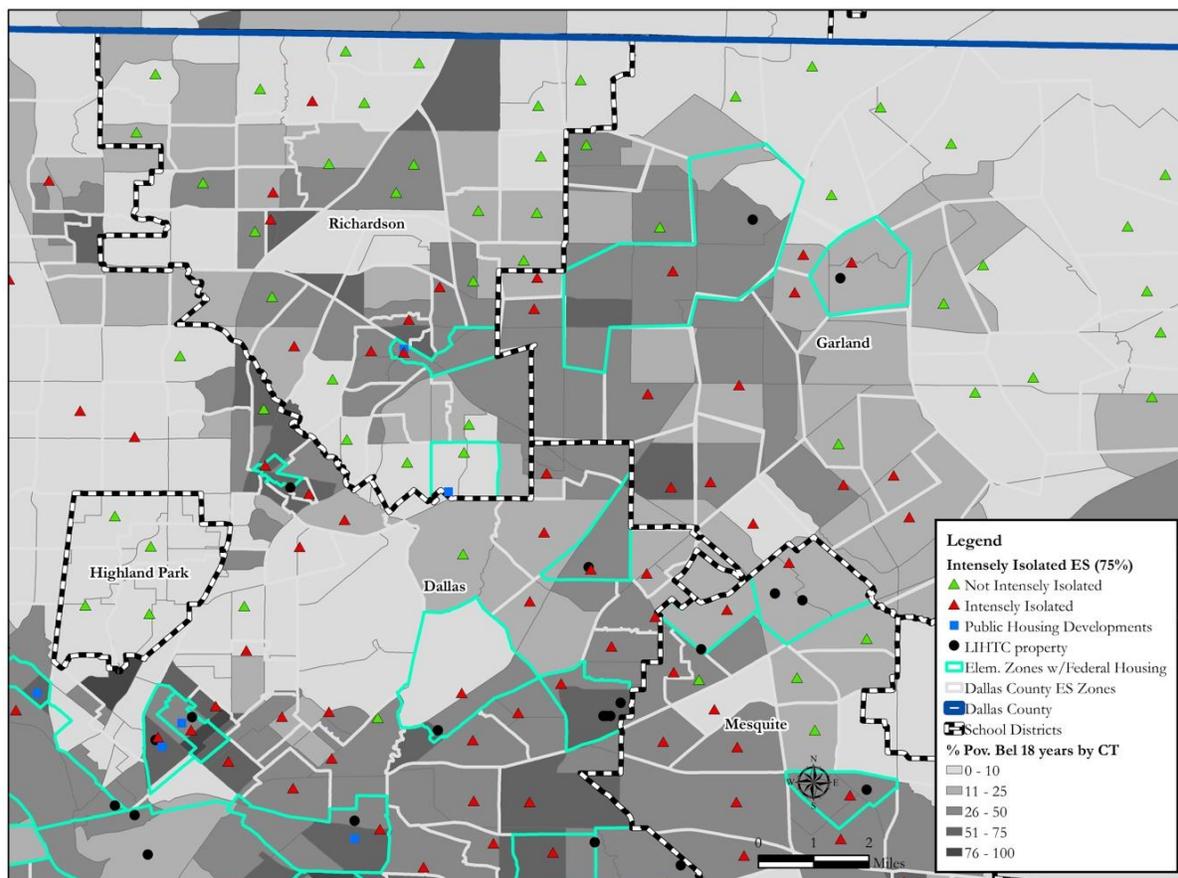
Source: US Census Bureau, 2012-2016 American Community Survey 5-year estimates; Texas Education Agency, NCES EDGE, US Department of Housing and Urban Development (2015-2016).

Importantly, the school segregation patterns we found are not fully explained by the demographic composition of the children who live in the subsidized housing developments. To consider whether segregation in schools was linked to the developments themselves, we obtained data on the number of children in public housing developments, as well as the number of units LIHTC developments (as no data were available on residents.) Our analysis revealed that the number of children in those developments would typically not be large enough to account for the high isolation we found in schools (assuming all children in the development are, in fact, attending their zoned school, which may not be the case.) While some developments are very large, these are the exception: in most counties, the public housing developments contain only a fraction (one-fifth to one-third) of the average enrollment of an elementary school (see Appendix, Table A-2). Further not all students in the developments are students of color, and, in LIHTC developments, not all students are low income. Thus, while the developments may indeed contribute to isolation, they are not solely the reason that schools that they are zoned to are so isolated but instead reflect the fact that developments are located in neighborhoods with high levels of school segregation. The

combination of housing (location) and educational policy decisions (zoning) explains the school segregation that results.

Student-level Segregation Measured by the Exposure Index

In the final step of our analysis, we consider how these broad patterns translate to the experiences of students in schools with and without subsidized housing zoned to them. We use the exposure measure, which allows us to understand the school composition of the "typical" students from different racial/ethnic backgrounds. Here we include only schools in districts that have federally subsidized housing units and eliminate 11 districts with neither type of federally subsidized housing programs in their borders in order to assure that our findings are not influenced by districts that would have no possibility of more evenly distributing subsidized housing among attendance zones. This results in an exclusion of 4% of schools from our analysis, which as mentioned above, have disproportionately higher White students and fewer low-income students.[8]

Economic Segregation Measured by Poverty Exposure. Our findings indicate that the presence of subsidized housing in a schools' attendance zone is associated with higher levels of economic segregation. The average student attending a school with subsidized housing in its zone (whether or not the student actually resides in subsidized housing) experiences greater exposure to students from economically disadvantaged backgrounds than same-race peers who have no subsidized housing in their school's zone (Table 3). This is particularly true when both types of housing (LIHTC and public housing) are present in the attendance zone. Yet, surprisingly, across all racial groups, there were relatively few differences by subsidized housing type (comparing LIHTC only and public housing only). Given that our maps also illustrate LIHTC properties are more disbursed beyond the urban core, we hypothesized that students might attend schools with lower poverty rates in schools with LIHTC properties in their zones. However, students in schools with LIHTC properties in their zone are exposed to as high, or higher, rates of poverty as schools with public housing in their zones. We also explored differences between school level (elementary, middle, and high) and found that these patterns in differences in exposure to poverty exist at all levels.

We also found stark disparities by race: our results indicate that the presence of subsidized housing is associated with even higher rates of exposure to economically disadvantaged students that already disproportionately affects Black and Latinx students. Even with no subsidized housing present in their zone, Black and Latinx students, on average, attended a school with much higher rates of poverty than White and Asian students, but the presence of subsidized housing is associated with more intense disparities. When we analyzed differences by school level, we found that at the elementary and middle school levels (results not shown)[9], the *highest* level of poverty in the school of the average White student—in schools with both types of subsidized housing-- never exceeded the *lowest* poverty rate for the average Black and` Latinx students with no subsidized housing. Thus, even when they did attend schools with subsidized housing, White and, to a lesser extent, Asian students were exposed to much lower levels of student poverty, on average.

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[8] Supplemental analyses including all 62 districts are available upon request from the authors. Patterns were not substantively different using all schools.
[9] Results available from authors upon request.

Table 3

Exposure to Economically Disadvantaged Students by Type of Subsidized Housing and Student Race/Ethnicity

Type of Housing in School Zone	White	Black	Latinx	Asian
No subsidized housing	35.1%	67.1%	70.7%	40.9%
Public housing only	44.7%	67.2%	80.2%	47.6%
LIHTC only	46.9%	75.2%	74.3%	60.0%
Both	49.5%	85.0%	83.1%	70.7%
Total	37.9%	70.6%	72.6%	45.5%

Note: Excludes districts without any subsidized housing
Source: Texas Education Agency, NCES EDGE, US Department of Housing and Urban Development (2015-2016).

In total, our findings suggest that there is a "racial dividend" that protects White students from attending a school with high poverty levels, regardless of what type of housing is in his or her attendance zone. In other words, regardless of where White students attend schools (subsidized housing present or not) White students are, on average, in more advantaged schools vis-à-vis poverty exposure than Black and Latinx students. This is likely because, given the history of housing segregation, White families tend to live in neighborhoods with a higher median income than Black or Latinx families with similar incomes (Reardon et al., 2015). Yet, our findings indicate that the presence of subsidized housing compounds high rates of exposure to economically disadvantaged students that already disproportionately affects Black and Latinx students.

Racial/Ethnic Segregation Measured by Racial/Ethnic Exposure

To examine racial segregation, we use the exposure index, which is a measure that has historically been used to measure segregation in U.S. schools and, by association, is an indicator of educational opportunity. As with our findings on economic segregation, we find that the presence of subsidized housing is associated with intensified levels of segregation for Black and Latinx students. In other words, the presence of subsidized housing is associated with higher levels of segregation as measured by the exposure index, but only for Black and Latinx students, and not White students.

Looking at segregation from White students vis-à-vis the exposure index, even though White students comprise less than 20% of students, across all grade levels, White students attend schools with much higher shares of White students in their schools, even for students in schools with *both* types of subsidized housing zoned to them (31.7%; see Table 5). The one exception to this is at the high school level, where the average White high school student attends school with just 16% White students, on average, if the school has both types of housing zoned to it (results not shown.)

Black and Latinx students, even in schools with *no* type of subsidized housing in their zone, attend schools with 15% or fewer White students, on average. Their segregation from White students as measured by exposure is considerably more severe, however, for students in schools with both types of subsidized housing (5% and 6%, respectively, for Black and Latinx students.) Black and Latinx high school students are slightly less segregated (as measured by exposure to White students) at the high school level, particularly in zones with no subsidized housing or public housing only.

Table 5

Exposure to White students by student race/ethnicity and type of subsidized housing

Type of housing in school attendance zone	White	Black	Latinx	Asian
No subsidized housing	38.5%	15.3%	13.7%	30.0%
Public housing only	34.3%	16.9%	9.3%	33.0%
LIHTC only	31.2%	7.8%	10.0%	17.7%
Both Public Housing and LIHTC	31.7%	5.1%	5.9%	15.3%
Total (all schools)	36.8%	12.3%	12.1%	27.2%

Note: Excludes districts without any subsidized housing
Source: Texas Education Agency, NCES EDGE, US Department of Housing and Urban Development (2015-2016).

Looking at segregation from Black and Latinx students vis-à-vis the exposure index, we find again that Black and Latinx students attend schools that are highly isolated, particularly when they attend schools with subsidized housing in their school's attendance zone (Table 6). Our results by school level (not shown) show that Black students in elementary, middle and high schools experience the highest levels of isolation when there is LIHTC housing in the student's attendance zone, or when both types of housing are present; at the middle and high school level Black students with public housing in their zones are somewhat less segregated (though they still attend schools with 70% Black and Latinx students at those levels). Latinx students experience segregation that is quite high even without any subsidized housing present, but it is even higher when any type of subsidized housing is present, and highest (exposure to Black and Latinx students is greater than 90%) when both types of housing are located in their school's attendance zones. Asian students' patterns of exposure are generally closer to—but not quite as stark as-- White students, and thus they tend to attend schools with disproportionately higher shares of White students and lower shares of Black and Latinx students, except if their school has both types of subsidized housing within their borders at the middle and high school levels.

Table 6

Exposure to Black and Latinx students by student race/ethnicity and type of subsidized housing

Type of housing in school attendance zone	White	Black	Latinx	Asian
No subsidized housing	50.1%	77.1%	80.8%	52.6%
Public housing only	56.4%	77.9%	87.6%	55.5%
LIHTC only	60.6%	87.0%	85.4%	68.8%
Both Public Housing and LIHTC	62.6%	92.6%	91.8%	77.9%
Total (all schools)	52.5%	81.2%	82.8%	56.4%

Note: Excludes districts without any subsidized housing
Source: Texas Education Agency, NCES EDGE, US Department of Housing and Urban Development (2015-2016).

In sum, the presence of subsidized housing in a school attendance zone is associated in general with deeper levels of racial isolation for Latinx and Black students, compared to same-race peers attending schools with no subsidized housing in their zones. This is true only in a few

instances for Asian students, and in one instance for White students. Further, as noted previously, these school segregation patterns are not fully explained by the demographic composition of the children who live in the subsidized housing developments.

Discussion

This analysis is one of the first to spatially examine patterns of school segregation vis-à-vis two types of federally financed affordable housing properties. As such, our findings offer unique insights into the connections between federal housing policy focused on lower-income households and educational opportunity.

Our results illustrate that public housing and LIHTC housing developments are disproportionately located in economically and racially isolated districts, and zoned to highly racially and economically isolated schools. This means that students who live in those affordable housing developments, as well as students living in the same attendance zones as those developments, are zoned to schools with high levels of economic and racial isolation.

We found that low-income students and Black and Latinx students were more affected by these patterns than White, Asian, and non-low-income students. Indeed, the presence of subsidized housing in a school's attendance zone was associated with higher levels of racial and economic segregation for Black and Latinx students than for White and Asian students; this is especially the case in schools where both types of subsidized housing properties were zoned to them. This lines up with our maps and with prior research cited earlier that shows that historically developments have been kept out of predominately White neighborhoods and concentrated into Black and Latinx neighborhoods. Our maps indicate that the developments are built near, or zoned to, schools serving Black and Latinx students, and our descriptive analysis finds higher patterns of segregation for those students. White students, however, are protected from extreme economic and racial segregation, no matter where they live (in the zone of a development or not). This is likely because, as noted previously, White children regardless of income levels tend to live in higher income neighborhoods than comparable Black and Latinx children (Reardon, Fox & Townsend, 2015).

To be sure, students in these communities may elect to attend schools of choice like magnet or charter schools. While magnet schools may offer more diverse educational options if structured with civil rights policies (see generally, Orfield & Frankenberg, 2013), research shows that charter schools are often as or more segregated when located in isolated communities (Frankenberg et al., 2011). Thus, choice is not necessarily a guarantee of more diverse schooling options.

The school segregation patterns we found vis-à-vis subsidized housing are a result of intentional policy decisions in multiple domains, and at multiple levels. First are the federal, state, and local policy decisions that created patterns of residential segregation between cities and suburbs that are clearly illustrated in our maps and which are the context for our analysis (Massey & Denton, 1993; Rothstein, 2017), and the concurrent decisions by states about where school district boundary lines would be constructed vis-à-vis these patterns (Holme & Finnigan, 2018; Siegel-Hawley, 2016). States have made decisions about school district boundary lines, which have historically followed patterns of municipal boundaries and have tended to follow residential segregation patterns (Holme & Finnigan, 2013; Siegel-Hawley, 2016) and in recent years, states have also determined the permissiveness of allowing communities to secede as well (EdBuild, 2019).[10] Research has shown

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[10] In some instances, courts have ordered the modification of school district boundaries for the purposes of school integration, yet more recently some states have permitted predominately white and high income communities to secede from more racially diverse districts, leading to further segregation (Siegel-Hawley et al., 2018).

that these school district boundary lines continue to contribute racial and income segregation between school districts (Bischoff, 2008; Frankenberg, 2009; Owens, 2016).

Second are decisions by policymakers and housing developers, within these contexts, that have resulted in the concentration of subsidized housing into disproportionately low income and non-White communities. As noted previously, these decisions are both the result of historical policy decisions, as well as the contemporary structure of these policies.[11] Our maps illustrated the clustering of many federally subsidized properties together in close proximity to one another, in areas of high racial isolation and poverty concentration for the under-18 population. This is particularly true for public housing properties, but is also true for LIHTC developments, although the latter are more dispersed. Indeed, we found that schools with LIHTC properties in their zones were often as segregated as those with public housing in their zones.

Third are decisions by school district leaders about the location of individual school attendance zone boundaries vis-à-vis subsidized housing properties. We found that properties were frequently zoned to racially and economically isolated schools, and, in a number of instances, we found that districts zoned multiple housing developments to the same school. In our analysis, schools with both types of housing in their zones (15% of zones) were the most isolated schools at all levels (elementary, middle, and high). This finding, coupled with the fact that many attendance zones had *no* subsidized properties in them, indicates that school districts' drawing of attendance boundaries are in part responsible for these patterns, particularly in places when properties could be dispersed among multiples zones. Indeed, as noted earlier, research on school attendance boundaries has pointed out that school districts frequently draw attendance boundaries in ways that further segregation (Richards, 2014; Siegel-Hawley, 2013), and our work illustrates that public housing may play a role in this. While our maps illustrate that some urban core districts and some inner ring suburbs have few more diverse schools available for properties to be zoned to, many districts do have the option to make more integrative zoning decisions with these properties, particularly in suburbs.

These collective layers of policy decisions shape the opportunities that families are able to provide to their children. Lower income households who are able to get access to subsidized housing have few choices within these contexts but to live in economically isolated neighborhoods, which are zoned, as our work shows, to economically and racially isolated schools. Households with more resources, by contrast, are able to make decisions about where to live or send their child to school in response to these patterns, and research suggests that their decisions often result in more segregation as they distance themselves from racially and economically isolated schools (Owens, 2015). The result of these collective decisions is racial and economic isolation between schools, and disparate educational opportunities (US GAO, 2016).

Some might argue that housing *should* be placed near where low-income families already live. Yet, research suggests that such placement isolates low-income families into neighborhoods with low opportunity, and often farther from jobs and other needed resources for mobility (banks, grocery stores, etc.; Chetty & Hendren, 2018; Drier et al., 2014), and often with limited transit into higher opportunity areas where those resources exist (Drier et al., 2014). Moreover, as our study and other scholars have shown, the consequences for school segregation, and thereby educational opportunity, are also affected by these locational decisions.

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[11] We thank one of the anonymous reviewers of our manuscript for this point.

Policy Implications

Our work indicates several potential actions for different types of actors. First, our work suggests more can be done by state and federal policymakers to incentivize the construction of federally subsidized affordable housing into a broader range of communities and school districts (Siegel-Hawley et al. 2017). One key example of this type of proactive approach in federal policy is the 2015 Obama administration rule that strengthened the commitment to the Affirmatively Furthering Fair Housing mandate, which was enacted in 1968, but inconsistently enforced (Haberle & Tegeler, 2019). This Obama administration rule required jurisdictions that received federal fair housing funds to examine patterns of racial bias in housing patterns, and formulate a plan to address that imbalance. (This rule, however, was suspended by the Trump Administration in 2018, which then proposed a significantly weaker replacement rule in 2019 [Lang, 2020].) State and federal policymakers can also encourage the adoption of Fair Share laws that require all jurisdictions within a region "…. provide a fair proportion of the region's affordable housing need, with accompanying power for developers to overcome unreasonable local zoning barriers" (Haberle & Tegeler, 2019, p. 972). This type of "fair share" requirement should not only apply to jurisdictions but *school districts* as well. With regard to LIHTC subsidized housing construction, state policymakers can incentivize the construction of housing in a broader array of communities and school districts through their Qualified Allocation Plans (QAPs) for distributing LIHTC credits, by prioritizing projects (i.e. awarding extra points) in diverse neighborhoods and near diverse schools, and eliminating the deduction of points for local opposition (Khadduri, 2013).[12]

Second, educational policymakers at the federal, state and local level can work to address the economic and racial segregation patterns that we found vis-à-vis these subsidized housing properties. Policymakers could, for example, proactively monitor attendance boundary drawing by districts to ensure properties are not zoned to segregated schools, particularly in suburbs where there is more potential for racially integrative boundary decisions. Intentionally taking into consideration racial demographics when drawing attendance boundaries is a permissible strategy under the US Supreme Court ruling in *Parents Involved v. Seattle School District No.* 1 (2007) to increase diversity in schools, and one that has been implemented in districts such as Berkeley, California and Louisville, Kentucky (Frankenberg, 2017). Partnered with this must be discussions about the value of school diversity specifically for more advantaged families that might be perceived to or would actually resist such rezoning and ways to ensure meaningful integration within diverse schools. The federal government and states could also incentivize actions by districts to integrate schools, i.e. by providing incentives for intra and interdistrict integration programs, or choice programs that prioritize racial integration (National Coalition on School Diversity, 2014).

A final implication of our work is the need for educational leaders at the state and local level to work in coordination with housing authorities, housing developers and city and regional planners, to ensure that properties are distributed across different types of communities and school districts. Holme and Finnigan (2018), for example, propose that states empower regional authorities to make decisions about the development of affordable housing in ways that ensure housing and schooling policy are made at a regional rather than local district level (see also Siegel-Hawley, 2016). The

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[12] One report found that, in Texas' 2013 change in their QAP system, which occurred in response to a lawsuit that accused the state's QAP of resulting in LIHTC projects in segregated neighborhoods near segregated schools, there was a significant increase in the number of LIHTC developments that were built in low poverty neighborhoods (Texas Low Income Housing Information Service, 2017), although this QAP change has since been reversed.

federal government could make state grants (education, transit, etc.) conditional on the state's development of affordable housing in different types of communities within major metropolitan areas (Haberle & Tegeler, 2019, p. 974).

As the recent U.S. Commission on Civil Rights (2018) report notes, housing and school policy often operate in separate silos despite the mutually reinforcing relationship between the two (Haberle & Tegeler, 2019; Orfield & Eaton, 1996; Siegel-Hawley, 2016; Siegel-Hawley et al., 2017). Ultimately, changing the relationship between federally subsidized housing and school segregation that we have documented in this analysis requires intentional coordination between policymakers and school district leaders to directly acknowledge and address these inter-relationships.

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Appendix

Table A-1
Intensely Segregated Schools (all districts) by level and housing in zone

		75/75%	*90/90%*	*All schools*
Elementary Schools				
None	Count	504	209	952
	%	52.9%	22.0%	
Public Housing only	Count	20	15	25
	%	80.0%	60.0%	
LIHTC only	Count	126	51	170
	%	74.1%	30.0%	
Both	Count	20	15	27
	%	74.1%	55.6%	
Total	Count	670	290	1174
	%	57.1%	24.7%	
Middle Schools				
None	Count	76	18	197
	%	38.6%	9.1%	
Public Housing only	Count	4	3	8
	%	50.0%	37.5%	
LIHTC only	Count	68	17	104
	%	65.4%	16.3%	
Both	Count	21	16	25
	%	84.0%	64.0%	
Total	Count	169	54	334
	%	50.6%	16.2%	
High Schools				
None	Count	19	3	77
	%	24.7%	3.9%	
Public Housing only	Count	2	0	5
	%	40.0%	0.0%	
LIHTC only	Count	22	2	70
	%	31.4%	2.9%	
both	Count	13	5	16
	%	81.3%	31.3%	
Total	Count	56	10	168
	%	33.3%	6.0%	
Four County Total				
None	Count	599	230	1226
	%	48.9%	18.8%	
Public Housing only	Count	26	18	38
	%	68.4%	47.4%	
LIHTC only	Count	216	70	344
	%	62.8%	20.3%	
both	Count	54	36	68
	%	79.4%	52.9%	
Total	Count	895	354	1676
	%	53.4%	21.1%	

Note: chi-squared tests showed differences are statistically significant ($P<.01$)

Table A-2

Size of developments compared to size of elementary schools by county (2018)

	Median number of **children** *in public housing developments by county*	*Median number of* **units** *in LIHTC developments by county*	*Median size of elementary schools by county (students)*
Bexar	126	172	611.5
Travis	123	192	568
Harris	350	160	733
Dallas	198	150	565

Sources: Texas Education Agency, US Department of Housing and Urban Development (2018).

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