Social and spatial inequalities of educational opportunity: A portrait of schools serving high- and low-income neighbourhoods in US metropolitan areas

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Abstract
Neighbourhoods and schools are both important contexts for children’s wellbeing. While often posited, little evidence documents inequalities in schools serving high- and low-income neighbourhoods. In this article, we use geospatial techniques to combine five administrative data sets to examine the characteristics of local public schools serving high- and low-income neighbourhoods in US metropolitan areas in 2013–2014. We find that high-income neighbourhoods are served by schools with greater social, financial, and instructional resources and greater student achievement than schools serving low-income neighbourhoods. Moreover, when metropolitan neighbourhoods are highly segregated by income, these inequalities are exacerbated. Our results demonstrate the link between neighbourhood and school disadvantage, with implications for policymakers concerned about social mobility and inequality.

Keywords
education, inequality, neighbourhood, poverty/exclusion, segregation

摘要
街区和学校都是事关儿童福祉的重要环境。虽然经常被假定，但很少有证据表明分别服务高收入和低收入街区的学校存在不平等现象。在本文中，我们使用地理空间技术将五个行政数据集合起来，以研究2013-2014年在美国大都市区分别为高收入和低收入街区服务的公立学校的特征。我们发现，与服务低收入街区的学校相比，高收入街区由具有更多社会、经济和教学资源以及更高学生成绩的学校提供服务。此外，当大都市街区被收入高度隔离时，这些不平等现象会加剧。我们的研究结果表明了街区和学校不利地位之间的联系，对政策制定者关注社会流动性和不平等具有参考价值。

关键词
教育、不平等、街区、贫困/排斥、隔离

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Neighbourhoods and schools

The robust neighbourhood effects literature demonstrates that neighbourhoods are a critically important context for children’s development and wellbeing, including their educational outcomes (Chetty et al., 2016; Sharkey and Faber, 2014). Hypotheses about why neighbourhoods matter – the mechanisms linking neighbourhood features such as socioeconomic disadvantage to children’s outcomes – have been proposed, but limited evidence exists on these mediating mechanisms. One proposed mechanism through which neighbourhoods affect children’s educational outcomes is neighbourhood institutional resources (Jencks and Mayer, 1990; Leventhal and Brooks-Gunn, 2000), specifically the local schools serving children’s neighbourhoods. In many countries, where a child lives determines or at least influences where she attends school, so one way neighbourhoods shape children’s outcomes is by affecting what school they attend.

Large bodies of research demonstrate the effects of neighbourhoods and schools on educational outcomes. The extant literature often considers these two contexts separately. The studies that do consider neighbourhoods and schools jointly when predicting youths’ outcomes reach differing conclusions about the relative importance of each context. For example, studies in the USA (Ainsworth, 2002; Carlson and Cowen, 2015), Sweden (Brannstrom, 2008), Finland (Kauppinen, 2008) and the Netherlands (Sykes and Musterd, 2011) show that school characteristics largely mediate the effect of neighbourhood characteristics on educational outcomes. However, in recent work on the USA, Wodtke and Parbst (2017) find that school poverty does not account for the effect of neighbourhood disadvantage on children’s achievement, and their results suggest that changing a child’s school makes little difference as long as he continues to live in a disadvantaged neighbourhood. Neighbourhood and school contexts also interact with one another in complex ways (Owens, 2010) and may have differential effects on different student groups (Pong and Hao, 2007). These studies are not strictly comparable because they vary in their designs and measurement of school and neighbourhood features, but a puzzle remains as to whether schools are a plausible pathway through which residence in a particular neighbourhood leads to children’s success or failure.

This article takes a different approach to considering the educational opportunities available to children who grow up in different neighbourhoods. Rather than estimate effects of neighbourhoods and schools (and family characteristics) on individual outcomes, we focus on describing the inequalities between schools serving neighbourhoods of different income levels and exploring whether income segregation in metropolitan areas exacerbates these inequalities. This approach is consistent with Oberti’s (2007) call for the need to examine ‘the link between social profiles of urban spaces and social profiles of schools’. While scholars, media, and the public often posit that children living in disadvantaged neighbourhoods attend lower-quality, lesser-resourced, or lower-performing schools than children living in advantaged neighbourhoods, little empirical evidence evaluates this claim.1 This article fills this gap in the literature by providing a rich descriptive account of the student body composition, school climate, teacher characteristics, school funding, and achievement levels in the local public schools serving high- and low-income students.
neighbourhoods in the USA. In the USA over the past several decades, children’s neighbourhoods have become increasingly unequal. Income segregation between neighbourhoods among families with children increased nearly 20% from 1990 to 2010 (Owens, 2016), so more children live in either homogenously affluent or homogenously poor neighbourhoods than in the past. Therefore, we also document how neighbourhood income segregation contributes to inequalities between the schools serving the highest-versus lowest-income neighbourhoods in a metropolitan area. Altogether, our analyses of local schools provide a portrait of the educational opportunities available to children growing up in high- and low-income neighbourhoods.

**Measuring school characteristics**

Educational research has identified many aspects of schools that may predict students’ success. This article focuses on several characteristics of schools, both inputs – student body, teacher, and school characteristics – and outputs – student achievement and achievement growth. Analyses are limited by characteristics easily quantified and measured by national administrative data sets, rather than more process-driven characteristics such as classroom culture or peer interactions.

First, we document the student body composition – racial/ethnic, economic, and ability – of schools serving high-versus low-income neighbourhoods. Since at least the Coleman report (Coleman et al., 1966), researchers have examined the role of peers in contributing to students’ success. Peers’ racial composition and the impact of racial segregation on the black–white educational achievement gap has received significant attention (Card and Rothstein, 2007; Cutler and Glaeser, 1997). A review of the literature indicates that attending school with more black peers disadvantages black, and to a lesser degree, white students (Vigdor and Ludwig, 2008). The effect size is small – Vigdor and Ludwig indicate that a 10% increase in black student share reduces achievement test scores for black students by less than 0.1 standard deviations. With respect to peers’ economic backgrounds, Schwartz (2012) provides causal evidence that low-income children’s achievement and achievement growth is greater in higher-income than lower-income schools, finding that low-income students attending schools with a poverty rate below 35% scored about 0.4 standard deviations higher on math assessments, with smaller effects for reading. Research also demonstrates that attending school with higher-achieving peers improves children’s outcomes. Hanushek et al. (2003) analyse administrative data from Texas public schools and find that a 0.1 standard deviation increase in peers’ achievement corresponds to a 0.02 standard deviation increase in one’s own achievement. Overall, peer effects studies demonstrate that with whom a student goes to school influences his or her achievement. We do not argue that school racial/ethnic, income, or ability composition is a measure of school quality. Rather, we argue that school composition is important because it shapes the economic, social, or cultural resources available to a child, such as teacher quality, school funding, parental involvement, or peers’ orientation toward achievement (Rumberger and Palardy, 2005).

Second, we consider the attendance and disciplinary climate in schools. Research demonstrates that chronic student absences are detrimental not only to the absent student’s achievement, but to the achievement of other students in the classroom of chronically absent students (Gottfried, 2011). Similarly, having more classroom peers that have been grade-retained slightly reduces non-retained students’ achievement test scores (Gottfried, 2013). A 1.0 standard deviation increase in chronically absent or
retained peers corresponds to declines of about 0.04–0.06 standard deviations in both reading and math. Researchers, educators, parents, and the media have also noted inequalities in disciplinary actions experienced by students of different racial/ethnic or socioeconomic backgrounds (Skiba et al., 2002). We examine whether there are inequalities in the disciplinary actions in schools serving high- or low-income neighbourhoods. Disciplinary action may proxy for disruptive student behaviour, which has spillover effects on peers, reducing test score performance (Figlio, 2007) or these measures may capture (possibly biased) differences in disciplinary practices. Broadly, the disciplinary and attendance variables provide one measure of the atmosphere or climate of the school.

Third, we examine inequalities in teacher characteristics between schools serving high- and low-income neighbourhoods. Teachers are perhaps the school input that researchers have most closely linked to student’s achievement (Goldhaber and Brewer, 1997; Rivkin et al., 2005). However, the characteristics of teachers that predict student success are less well understood. There is mixed research on whether teacher credentials or small class sizes matter as much as often thought, while more robust evidence indicates that teacher experience is an important predictor of children’s outcomes (Clotfelter et al., 2007; Greenwald et al., 1996; Loeb and Page, 2000). Clotfelter and colleagues, for example, find that teachers with 3 to 5 years of experience produce gains in math and reading that are about 0.02 standard deviations larger compared with teachers with 1 to 2 years of experience. Teachers with over 20 years of experience produce gains about twice as large as do teachers with 1 to 2 years of experience. Some research demonstrates that teachers’ salaries are also positively linked to students’ achievement and attainment (Hedges et al., 1994; Jackson et al., 2016).

Fourth, we examine differences in per-pupil funding between schools serving high- and low-income neighbourhoods. School funding derives from federal, state, and local sources, so variation is primarily at the district, rather than school, level. Families are segregated between school districts by income (Owens et al., 2016), so high- and low-income neighbourhoods are often located in separate districts that may have different funding levels. Local school revenues in the USA are based, in part, on district property taxes, so higher-income districts typically have greater local revenues than lower-income districts. School finance reform since the 1970s has reduced inequalities in the funding levels of high- and low-income districts, but in many states, high-income districts still receive more resources than low-income districts because of revenues from income and sales taxes (Baker and Corcoran, 2012; Baker et al., 2017). Moreover, income segregation creates districts of concentrated poverty, where the costs of educating one poor child may be higher than in more integrated districts. Few states have sufficient compensatory funding to produce the same outcomes for a poor student in a low-income compared with a high-income district (Baker and Green, 2015). Scholars debate whether school spending contributes to students’ achievement (Hanushek, 2003), but recent comprehensive causal evidence indicates that higher per-pupil spending increases students’ educational attainment and future economic outcomes (Jackson et al., 2016).

Fifth, we explore measures of school quality in terms of outputs: students’ test scores. We assess how schools perform on their states’ accountability tests, compared with other schools in the state. Achievement levels are, of course, an imperfect way to capture schools’ quality and efficacy, as they are conflated with the demographic and pre-existing ability composition of the student
body (Downey et al., 2008). A preferred, though still imperfect, measure is to consider growth in proficiency levels over time, which we examine at the school level.

Finally, after documenting differences in the schools serving high- and low-income neighbourhoods along these five dimensions, we examine whether differences are larger in metropolitan areas with greater income segregation between neighbourhoods. Greater income segregation implies that the lowest income neighbourhoods will be more homogenously poor and the highest income neighbourhoods will be more homogenously rich. Segregation also concentrates other characteristics associated with family income (just as racial segregation concentrates poverty, given the association between race and income (Massey et al., 1994)). Further, in metropolitan areas with greater income segregation, the geographic clustering of high- and low-income neighbourhoods may be higher (Dwyer 2010), so schools drawing from several neighbourhoods serve less diverse populations. Greater neighbourhood inequalities in more segregated places may be reflected in the schools serving high- and low-income neighbourhoods.

**Data and methods**

**Defining high- and low-income neighbourhoods**

We use the five-year aggregate 2011–2015 American Community Survey (ACS) data to classify census tracts (neighbourhoods) according to their median household income. We create quintiles of neighbourhoods by median household income within their metropolitan area, including all metropolitan neighbourhoods. We replicated analyses defining neighbourhood socioeconomic status (SES) by poverty rate and concentrated disadvantage, which support similar substantive conclusions. Appendix Table A1 presents additional socioeconomic indicators by neighbourhood income quintile. We present results based on neighbourhood income quintile because of its clearer link to income segregation between neighbourhoods, the second part of our analysis. We define neighbourhoods as tracts to be consistent with the bulk of quantitative neighbourhood research in the USA.

**Linking neighbourhoods and schools**

To identify the schools serving each neighbourhood, we use a school–neighbourhood link data set created by Candipan (2017). The data set provides a crosswalk between public school identifiers and identifiers for multiple Census geographies, including blocks and tracts. Candipan used geospatial techniques to link US public schools to blocks and tracts drawing on 2013–2014 school attendance boundary shape files provided by the School Attendance Boundary Survey (SABS) (Phan, 2015). SABS is a biennial voluntary survey collected by the US Department of Education that produces geographic catchment area data for public schools serving kindergarten through 12th grades in the USA. Response rates for regular school districts and schools were 90% and 86%, respectively (Phan, 2015). Ninety-five percent of blocks, the smallest level of Census geography, are circumscribed within attendance boundaries, while tracts are frequently bisected, served by multiple schools. On average, about 2.5 schools serve each tract. The crosswalk provides population weights to indicate the share of the tract’s population served by each school, based on total block-level population data. When tracts are served by more than one school (the maximum number is 11, the median is 2), we take a weighted average of the characteristics of all schools serving that neighbourhood, with the weight proportional to neighbourhood population served. We therefore present average characteristics of
the schools serving neighbourhoods in different income quintiles. We focus on elementary schools and use a crosswalk based on schools serving the 4th grade.

Geographic coverage is not universal in SABS – approximately 17% of tracts in the 2011–2015 ACS are not linked to school attendance boundaries in 2013–2014. Analyses of tract characteristics, including median household income, between those included and excluded from SABS do not reveal notable differences. We present results for all metropolitan area tracts \( N = 47,950 \) covered by SABS, which includes at least one tract from 378 (of 380) metropolitan areas in the USA. On average, 84% of tracts in each metropolitan area are included in the sample, and at least 75% of tracts are included in over 75% of metropolitan areas. Appendix Table A2 presents sociodemographic characteristics of the metropolitan areas in the sample.\(^5\)

**School characteristics**

We measure characteristics of the local public schools linked to each neighbourhood via three administrative data sets provided by government agencies: Common Core of Data (CCD), Office of Civil Rights (OCR) data, and EDFacts. The CCD publishes school-level enrollment counts by race/ethnicity and economic status annually. The CCD also produces the Local Education Agency (School District) Finance Survey data (F-33) on school funding. We access the F-33 data via the School Funding Fairness Data System (SFF) (Baker et al., 2016). OCR restricted-use data provides school-level data in 2013–2014 on student body, teacher, curricular, and disciplinary characteristics. EDFacts provides school-level data on state-administered proficiency tests in 2013–2014. In describing the features of public schools serving high- and low-income neighbourhoods, we exclude charter and magnet schools to focus on the local neighbourhood schools.\(^6\) We explore the following school characteristics from these data sets for all public traditional schools in the sample, with the data source indicated in parentheses.

- **School composition**: racial composition (proportion non-Hispanic white, black, Asian, and Hispanic, CCD); free/reduced price lunch (FRPL) eligibility rate (students whose family income is less than 185% of the federal poverty threshold are FRPL eligible; though flawed, this is the only nationally available indicator of students’ economic status, CCD); Limited English Proficiency (LEP) rate (OCR); Gifted and Talented (GATE) rate (OCR).\(^7\)

- **School absenteeism and disciplinary climate (OCR)**: rates of chronic absenteeism (students absent 15 days or more), suspension (proportion of students with at least one out-of-school suspension), and grade retention.

- **Teacher characteristics (OCR)**: students–teacher ratio, proportion of certified teachers, proportion of first- or second-year teachers, average teacher salary, adjusted by the Education Comparable Wage Index (ECWI) to account for differences in cost of living across labour markets (Taylor and Fowler, 2006; Weber et al., 2016).

- **School funding**: district-level total per-pupil spending (sum of spending on instruction, support services, and other), adjusted by the ECWI. For the school funding analysis, we follow past research and drop schools with values greater than 150% of the 95th percentile and less than 50% of the 5th percentile to account for outliers (Murray et al., 1998).

- **Achievement and growth (EDFacts)**: EDFacts provides data on the proportion of students meeting state-determined proficiency standards on
reading and math standardised accountability tests. We focus on the proportion of 4th grade students exhibiting proficiency in math and reading in 2013–2014 and the school-level change in the proportion of 4th graders proficient from 2009–2010 to 2013–2014. This growth measure shows changes in school-level proficiency rates over time and does not measure cohort learning or account for changes in the student body. To account for differences between states in accountability tests and definitions of proficiency, we percentile rank all schools in each state, regardless of whether they are in the analysis sample, by their level of proficiency in 2013–2014 or level of growth from 2009–2010 to 2013–2014 and classify schools by their achievement level or growth percentile within their state.

Measuring income segregation between neighbourhoods

After comparing the characteristics of schools serving high- and low-income neighbourhoods, we examine whether differences in these characteristics are larger in metropolitan areas with greater income segregation between neighbourhoods. We use the rank-order information theory index \( H \) to estimate income segregation within metropolitan areas between tracts, using 2011–2015 ACS data on household income. \( H \) compares the income distributions within neighbourhoods to the income distribution in the metropolitan area. It can range from a theoretical minimum of 0 (no segregation; all neighbourhoods have identical income distributions to the metropolitan area distribution) to a theoretical maximum of 1 (total segregation; all neighbourhoods are composed of households in only one income category and there is no income diversity within neighbourhoods) (Reardon, 2009). We apply the bias-correction method to estimating income segregation with small sample sizes described in Reardon et al. (2018). We divide metropolitan areas into quintiles of income segregation and compare characteristics of schools serving high- and low-income neighbourhoods in more or less segregated places.

Results

Linking these data sets on neighbourhoods and schools provides us with a portrait of the schools serving most neighbourhoods in US metropolitan areas, which consist of both cities and their surrounding suburbs. We first present characteristics of schools serving neighbourhoods in each income quintile (defined within metropolitan areas). Then, we present school characteristics by neighbourhood income quintile across metropolitan area income segregation quintiles. Our analyses are descriptive and bivariate; we do not argue that neighbourhood conditions cause school characteristics. Rather we are describing the inputs and outputs of schools serving neighbourhoods of different income levels.

School composition

First, we examine the racial/ethnic composition of the student body. Table 1 presents means for schools serving neighbourhoods in each income quintile, and Figure 1 presents box plots of the population share from the four largest racial/ethnic groups. The boxes span the 25th to 75th percentiles, with the median marked inside the boxes, and the whiskers indicate the 10th and 90th percentiles within each income quintile.

Schools serving the lowest-income neighbourhoods (quintile 1) have the smallest proportion of white and Asian students and the largest proportions of Hispanic and black students. Conversely, schools serving the highest-income neighbourhoods have the largest white and Asian populations and
Smaller Hispanic and black populations. Strikingly, about three-quarters of high-income (Q5) neighbourhoods are served by majority-white schools. More than three-quarters of low-income (Q1) neighbourhoods are served by majority non-white schools. Schools serving the highest-income neighbourhoods are, on average, 63% white compared with 24% in schools linked to the lowest-income neighbourhoods (the national public school rate was 50% in 2014).

Next, we examine the FRPL, LEP, and GATE rates (Table 1, Figure 2). Schools serving the lowest-income neighbourhoods have the most disadvantaged student bodies, with, on average, 78% FRPL, 21% LEP, and 7% GATE students, compared with 30% FRPL, 8% LEP, and 10% GATE in schools in the highest-income neighbourhoods. National rates were 52%, 10%, and 7%, respectively (National Center for Education Statistics, 2015), so the GATE rate in the lowest-income neighbourhoods is at the national average. Three-quarters of schools serving the highest-income neighbourhoods are less than 50% FRPL while three-quarters of schools serving the lowest-income neighbourhoods are more than 70% FRPL.

There are substantial differences in the composition of the student populations in the schools serving high- and low-income neighbourhoods. While not surprising that schools serving disadvantaged neighbourhoods have disadvantaged student...
Figure 1. School racial/ethnic composition by neighbourhood income quintile.

Notes: White, black, and Asian refer to non-Hispanic persons. Boxes span the 25th to 75th percentile of school characteristics, with medians represented by horizontal lines inside the boxes. Whiskers represent the 10th and 90th percentiles.

Figure 2. School FRPL, LEP, and GATE rates by neighbourhood income quintile.

Notes: FRPL, free or reduced-price lunch; LEP, limited English proficient; GT, gifted and talented education. Boxes span the 25th to 75th percentile of school characteristics, with medians represented by horizontal lines inside the boxes. Whiskers represent the 10th and 90th percentiles.
populations, these findings suggest potential consequences. Attending school with disadvantaged peers can have negative effects on student achievement, exacerbating the challenges that many students face at home and in their neighbourhoods.

**School attendance and disciplinary climate**

Table 1 presents average rates of chronic absenteeism, suspension, and grade retention in the schools serving neighbourhoods in each income quintile. Inequalities between the schools serving higher- and lower-income neighbourhoods are evident, though more modest than the patterns observed for school composition. In the lowest-income neighbourhoods, about 15% of students are chronically absent, compared with 8% in the highest-income neighbourhoods (nearly a 1 standard deviation difference). There are higher rates of suspensions (5% vs 1.3%) and grade retention (3% vs 1.7%) in schools serving the lowest-versus the highest-income neighbourhoods, differences of 0.5 to 0.75 of a standard deviation. These data cannot adjudicate between claims that either children living in different neighbourhoods act differently or that the schools they attend treat them differently; instead, these data show differences in the climates of schools serving advantaged versus disadvantaged neighbourhoods. Attendance and discipline practices may have spillover effects on students who do not exhibit the behaviour. The magnitude of these differences may grow in high schools when the level of behaviour problems is generally higher.

**Teacher characteristics**

Table 1 next describes features of schools’ teachers. First, the average student–teacher ratio varies little across schools serving neighbourhoods of different income levels. Across schools serving all neighbourhoods, the average rate of teachers who are not state certified is very low, less than 3%, though the rate is more than twice as high in schools serving the lowest- versus highest-income neighbourhoods. Unfortunately, OCR data do not provide information on more detailed certification, such as subject matter expertise or advanced degree. Schools serving the lowest-income neighbourhoods tend to have a greater proportion of inexperienced teachers – those in their first or second year – than schools serving the highest-income neighbourhoods, 14% compared with 9%, on average.

Table 1 presents the mean teacher salary, adjusted by the ECWI, in schools by neighbourhood income quintile. Teachers in schools serving the highest-income neighbourhoods are paid nearly US$3500 more than in schools serving the lowest-income neighbourhoods (US$54,351 versus US$57,787). Average teacher salary might be higher in schools serving high-income neighbourhoods because teachers are more experienced. Estimates of teacher salary adjusted for the proportion of first- or second-year teachers indicate smaller salary differences across neighbourhood income quintiles, reducing the gap between the highest- and lowest-income neighbourhoods to US$2203. Differences of this magnitude correspond to roughly 2% of a standard deviation difference in student achievement (Greenwald et al., 1996) and 1% difference in graduation rates (Loeb and Page, 2000).9

**School funding**

Per-pupil spending varies modestly between the schools serving higher- and lower-income neighbourhoods. Across all neighbourhood income quintiles, schools spend approximately US$10,500, with schools serving the lowest-income neighbourhoods spending US$350 more than schools serving the highest-income neighbourhoods (Table
1). The similarity in funding across neighbourhood income levels indicates that school finance reform has been somewhat effective. For the average child, the substantive impact of a 3% difference in spending, as observed here between the highest- and lowest-income neighbourhoods, corresponds to about 0.1 more completed years of education, 2% higher wages, and 1 point reduction in adult poverty risk (Jackson et al., 2016). However, research indicates that the cost of educating a low-income child is higher (estimates range from 5% to 160% higher) than that of educating a high-income child (Duncombe et al., 2015), especially a low-income child in a school where 78% of peers are also low-income, as we demonstrate is the average case in low-income neighbourhoods. Therefore, equal or slightly progressive funding between low- and high-income neighbourhoods may not indicate equal outcomes.

**Proficiency achievement levels and growth**

Finally, Table 1 and Figure 3 present achievement proficiency for 4th graders of schools serving neighbourhoods in each income quintile. We present within-state percentile ranks of proficiency levels or growth. Schools serving neighbourhoods in the highest-income neighbourhoods had proficiency levels in reading and math at about the 70th percentile, on average, in their state. Lower-income neighbourhoods are served by schools ranked lower in their state. The lowest-income neighbourhoods are served by schools that are, on average, at about the 30th percentile of reading and math achievement. Examining raw proficiency rates without regard to within-state rankings, over 75% of students in schools serving the highest-income neighbourhoods were proficient in math and reading compared with about 52% in schools serving the lowest-income neighbourhoods.

Table 1 also presents reading and math proficiency growth between 4th grade cohorts in 2009–2010 and 2013–2014, classifying schools by their within-state growth percentile. These growth measures are at the school-level, tracking how 4th grade achievement has changed, not tracking individual students’ or a cohort of students’ growth. Schools serving the highest-income neighbourhoods rank higher in proficiency growth compared with schools serving the lowest-income neighbourhoods (percentile rankings of 55–57 versus 44–45 for math and reading). Consistent with past work, there are starker differences in the level of achievement than in achievement growth between schools serving advantaged and disadvantaged populations. Figure 3 presents both achievement level and growth for math scores, illustrating these gradients. The minimal overlap in the achievement distribution (grey bars) of the highest- and lowest-income neighbourhoods is striking – 90% of high-income neighbourhoods are served by schools with achievement well above the median of schools serving low-income neighbourhoods. Achievement growth is more variable, though still generally lower in the lowest-income neighbourhoods.

**Are school inequalities exacerbated by residential income segregation?**

Income segregation between neighbourhoods creates very high- and very low-income neighbourhoods. In more segregated metropolitan areas, neighbourhoods in the highest income quintile will be more homogenously affluent and neighbourhoods in the lowest income quintile will be more homogenously poor. Neighbourhoods are more economically diverse in more integrated metropolitan areas. Therefore, the inequalities between schools serving the highest- and lowest-income neighbourhoods may be larger in more segregated metropolitan
areas. We re-examined several school characteristics with striking inequalities in our results above or that might be highly associated with neighbourhood income: proportion FRPL eligible, teacher salary, school expenditures, and achievement level and growth.

Table 2 presents the mean values by neighbourhood income and metropolitan area segregation quintiles. For example, the first row presents the average proportion of students that are FRPL-eligible in schools serving neighbourhoods in each income quintile in the least segregated metropolitan areas (quintile 1). The difference in FRPL rate in schools serving the highest- and lowest-income neighbourhoods is 23 percentage points (66% versus 43%). Comparing down the first column, the FRPL rate in the lowest-income neighbourhoods in the most integrated metropolitan areas is 66%, compared with 84% in the most segregated metropolitan areas. Residential income segregation clearly exacerbates the inequalities in the schools serving high- and low-income neighbourhoods. Moreover, the larger gap in highly segregated metropolitan areas occurs both because of higher FRPL rates in schools serving low-income neighbourhoods and very low FRPL rates in schools serving the highest-income neighbourhoods – 27% in the highest-income neighbourhoods in the most segregated metropolitan areas, compared with 43% in the highest-income neighbourhoods in the least segregated areas. This demonstrates that one important way

![Figure 3. Math achievement and growth percentiles by neighbourhood income quintile. Notes: The y-axis indicates achievement or growth percentile within states. Boxes span the 25th to 75th percentile of school characteristics, with medians represented by horizontal lines inside the boxes. Whiskers represent the 10th and 90th percentiles.](image)
that income segregation contributes to inequality is by creating very affluent enclaves (Massey, 1996; Owens, 2016; Reardon and Bischoff, 2011). Table 2 shows that the average median income in the highest-income neighbourhoods in the least segregated metropolitan areas is US$67,850 compared with US$109,713 in the most segregated metropolitan areas.

Table 2 presents the average teacher salary in the schools serving neighbourhoods by income quintile in the most (bottom panel) and least (top panel) segregated MSAs in the sample. The gap in teacher salary between schools in the highest- and lowest-income neighbourhoods is larger in the most than in the least segregated MSAs – US$4849 versus US$3205, differences of 9% and 6%, respectively. Adjusting for teacher experience, the gaps are US$3564 (6%) and US$2291 (4%) in the least and most segregated metropolitan areas, respectively. Again, comparing more or less segregated metropolitan areas reveals that inequalities between schools serving high- and low-income neighbourhoods are exacerbated by income segregation.

Table 2 also presents the average level of per-pupil expenditures across neighbourhood income quintile and metropolitan area income segregation quintile. The difference in expenditures between the highest- and lowest-income neighbourhoods is fairly similar across income segregation quintiles. In fact, the gap between schools serving the lowest- and highest-income neighbourhoods is nearly identical in the least versus most segregated areas (US$260 versus US$270). While it is encouraging that income segregation has not exacerbated spending inequality, educating low-income students will cost even more in very poor neighbourhoods and schools, so more progressivity may be required in very segregated metropolitan areas (Duncombe et al., 2015). Moreover, the inequalities in teacher salary demonstrate that schools serving high- and low-income neighbourhoods may allocate their spending differently. Lafortune et al. (2016) show that little of the increase in relative funding resulting from school finance reforms in low-income school districts is used for instructional expenditures, because these districts must spend a considerable amount on capital (e.g. physical maintenance and renovation).

Finally, we examine inequalities in achievement level and growth in the schools serving neighbourhoods by income quintile in the least and most segregated MSAs. Income segregation between neighbourhoods exacerbates achievement inequalities between schools serving high- and low-income neighbourhoods. Schools serving low-income neighbourhoods rank worse in highly segregated MSAs – for math, at the 31st percentile in their state, compared with the 40th percentile in the least segregated MSAs – and schools serving high-income neighbourhoods rank better in highly segregated MSAs – at about the 73rd percentile in their state, compared with the 59th in the least segregated MSAs (Table 2).

A similar pattern emerges for reading and math proficiency growth from 2009–2010 to 2013–2014. In both the least and most segregated MSAs, schools serving the lowest-income neighbourhoods have proficiency growth rates between 43% and 45% for math and reading (column 1). But in schools serving the highest-income neighbourhoods, proficiency growth rates are about 49% in the most integrated MSAs and 56% to 59% in the most segregated MSAs (column 5), again showing that inequalities arise as segregation creates high-income enclaves.

Discussion

This article links five administrative data sets together in a novel way to provide a comprehensive portrait of the local public schools serving high- and low-income
neighbourhoods in US metropolitan areas. This rich descriptive story is missing from analyses of how neighbourhood and school contexts reinforce or mediate one another’s effects. Across nearly all school indicators, a consistent story emerges: schools serving

Table 2. Average school characteristics by neighbourhood median income quintile and metropolitan area income segregation quintile, 2013–2014

| Segregation quintile | Neighbourhood income quintile  |
|----------------------|--------------------------------|
|                      | 1 | 2 | 3 | 4 | 5 |
| 1 Percent FRPL eligible | 65.95% | 59.29% | 54.31% | 49.67% | 42.98% |
| Teacher salary | US$53,378 | US$53,528 | US$53,155 | US$55,342 | US$56,583 |
| Per-pupil expenditures | US$110,071 | US$10,982 | US$11,050 | US$10,985 | US$10,811 |
| Math achievement pctl | 40.23 | 44.62 | 48.64 | 51.54 | 58.69 |
| Reading achievement pctl | 39.85 | 45.12 | 48.99 | 52.72 | 62.05 |
| Math growth pctl | 43.33 | 44.35 | 46.89 | 47.39 | 49.35 |
| Reading growth pctl | 45.60 | 45.76 | 46.07 | 47.63 | 49.69 |
| Median neighbourhood inc | US$31,985 | US$42,471 | US$48,798 | US$56,196 | US$67,850 |
| 2 Percent FRPL eligible | 71.93% | 63.47% | 57.11% | 51.62% | 41.84% |
| Teacher salary | US$54,246 | US$55,333 | US$56,006 | US$55,473 | US$57,152 |
| Per-pupil expenditures | US$10,898 | US$11,035 | US$11,053 | US$10,935 | US$10,662 |
| Math achievement pctl | 33.56 | 43.11 | 50.11 | 55.68 | 63.67 |
| Reading achievement pctl | 34.35 | 43.25 | 51.12 | 55.67 | 65.89 |
| Math growth pctl | 43.47 | 45.09 | 47.03 | 50.09 | 54.15 |
| Reading growth pctl | 45.93 | 44.68 | 47.24 | 50.30 | 53.34 |
| Median neighbourhood inc | US$31,466 | US$43,746 | US$51,826 | US$60,067 | US$78,922 |
| 3 Percent FRPL eligible | 73.69% | 63.41% | 53.22% | 45.87% | 33.92% |
| Teacher salary | US$53,698 | US$53,316 | US$55,345 | US$54,704 | US$56,507 |
| Per-pupil expenditures | US$10,761 | US$10,813 | US$10,467 | US$10,662 | US$10,935 |
| Math achievement pctl | 35.38% | 44.11% | 50.55% | 58.66% | 67.44% |
| Reading achievement pctl | 34.34% | 43.25% | 51.12% | 55.67 | 69.85% |
| Math growth pctl | 46.22 | 48.20 | 49.82 | 52.46 | 56.01 |
| Reading growth pctl | 47.51 | 47.99 | 49.01 | 51.87 | 55.02 |
| Median neighbourhood inc | US$32,724 | US$47,204 | US$57,815 | US$69,463 | US$93,151 |
| 4 Percent FRPL eligible | 74.82% | 63.81% | 52.94% | 41.86% | 28.70% |
| Teacher salary | US$57,223 | US$56,679 | US$56,870 | US$57,362 | US$58,603 |
| Per-pupil expenditures | US$11,175 | US$10,813 | US$10,380 | US$10,480 | US$10,935 |
| Math achievement pctl | 33.45% | 42.51% | 50.27% | 59.95% | 70.56% |
| Reading achievement pctl | 30.63% | 40.78% | 48.91% | 58.51% | 70.37% |
| Math growth pctl | 45.26 | 46.84 | 48.74 | 52.17 | 56.38 |
| Reading growth pctl | 47.95 | 48.56 | 48.83 | 50.49 | 55.55 |
| Median neighbourhood inc | US$31,452 | US$46,516 | US$58,071 | US$71,674 | US$99,934 |
| 5 Percent FRPL eligible | 83.95% | 73.16% | 59.67% | 44.90% | 27.30% |
| Teacher salary | US$53,082 | US$54,590 | US$54,876 | US$55,914 | US$57,930 |
| Per-pupil expenditures | US$10,493 | US$9,869 | US$9,921 | US$10,223 | US$10,935 |
| Math achievement pctl | 30.74 | 39.65 | 49.54 | 59.98 | 73.40 |
| Reading achievement pctl | 27.82 | 38.18 | 49.58 | 61.68 | 74.31 |
| Math growth pctl | 43.51 | 46.16 | 49.06 | 53.09 | 59.54 |
| Reading growth pctl | 44.12 | 46.63 | 49.01 | 52.65 | 56.13 |
| Median neighbourhood inc | US$28,950 | US$43,979 | US$57,232 | US$73,611 | US$109,713 |

Notes: FRPL, free or reduced-price lunch. Teacher salary and per-pupil expenditures adjusted by the ECWI. Achievement and growth percentiles are within state. Segregation quintile 1 refers to the least segregated metropolitan areas; quintile 5 refers to the most segregated metropolitan areas.
high-income neighbourhoods have greater social, economic, and instructional resources than schools serving lower-income neighbourhoods. Low-income neighbourhoods’ schools enroll more disadvantaged students, experience greater absences and disciplinary measures, have fewer experienced or certified teachers, pay teachers lower salaries, and have lower achievement and achievement growth. Income segregation between neighbourhoods exacerbates these school inequalities. In the USA, children have become more segregated by income over the past several decades, driven in part by the clustering of very high-income families. High-income neighbourhoods in the most segregated places are served by very advantaged schools, reinforcing family and neighbourhood advantages in these places.

One exception to this conclusion is school funding, which is fairly equal, or even compensatory, across neighbourhoods of varying income levels. However, equal funding likely does not produce equal outcomes in schools serving high- and low-income neighbourhoods. Educating one low-income student costs more than educating one high-income student, and educating one low-income student in a high-poverty school costs more than in a low-poverty school. To produce equal outcomes, the financial inputs may need to be much more progressive, with additional funding to high-poverty schools in segregated neighbourhoods, rather than equal. In the USA, school finance reforms since the 1970s have recognised and addressed this to some extent. However, over the past several decades, finance reforms have focused on adequacy for minimal achievement rather than equity (or progressivity) between high- and low-income places (Baker and Green, 2015).

Inequality between schools serving high- and low-income neighbourhoods is perhaps not surprising – the demographic composition of schools reflects local neighbourhoods, and neighbourhood SES contributes partially to schools’ financial resources. However, past literature suggests that these school characteristics shape the achievement of students, so if we take these characteristics as a portrait of the peers, climate, teachers, and resources in schools serving children from high- and low-income neighbourhoods, there are troubling implications for inequality in children’s outcomes. Indeed, schools serving higher-income neighbourhoods have higher levels of achievement and achievement growth than in lower-income neighbourhoods. While school-level achievement data cannot be used to estimate effects of neighbourhood or school contexts on individual students, schools serving disadvantaged neighbourhoods appear to be struggling.

One limitation of this study is that there is infrequent consensus in past research about how much any of these school characteristics matters for students’ outcomes. It is therefore challenging to gauge how impactful the inequalities in school contexts are. However, our analyses clearly show that low-income neighbourhoods face a confluence of factors that past research identifies as detrimental for children’s outcomes. To ameliorate these inequalities, their schools would need greater resources than schools serving advantaged students in advantaged neighbourhoods to produce equal outcomes. Policymakers must continue to consider how affordable housing policies and educational policies can facilitate neighbourhood and school integration and access to equal opportunities.

Overall, this article fills a gap in the empirical literature by providing a rich descriptive portrait of the schools serving high- and low-income neighbourhoods in US metropolitan areas. Schools are both a key context in children’s development and a proposed mechanism through which neighbourhood residence influences children’s outcomes, so documenting these inequalities is important in understanding what contributes to inequality in children’s success.
Both neighbourhood and school contexts matter, and they are intertwined with one another. School quality shapes the residential decisions parents make, leading to neighbourhood inequality; and neighbourhood inequality shapes the resources available in the local schools. Where a child grows up clearly influences the type of school she attends, and policies aimed at reducing inequality must focus on breaking the link between disadvantaged schools and neighbourhoods.

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Notes

1. Some research shows that disadvantaged children attend schools with fewer resources than advantaged children, but these studies do not evaluate spatial inequalities between neighbourhoods (Goyette, 2017; Phillips and Chin, 2004).
2. Metropolitan areas are defined as core based statistical areas and divisions by the 2013 Office of Management and Budget.
3. Alternative neighbourhood SES measures included (1) categorising neighbourhoods as having population share below the federal poverty threshold of <10%, 10 to 19.9%, 20 to 29.9%, 30 to 39.9%, or 40%+ (Jargowsky, 1997); and (2) creating a concentrated disadvantage index (Sampson et al., 2008) using factor analysis to combine neighbourhoods’ rates of unemployment, welfare, female-headed household, poverty, and residents with at least a college degree or less than a high school diploma. We then created quintiles of neighbourhoods by their concentrated disadvantage score within metropolitan areas. We present results from household income quintiles; results from concentrated disadvantage quintiles are very similar. Results from the poverty categories differ slightly because the majority of neighbourhoods have poverty rates below 10%.
4. Local school districts reported attendance boundary data. Maps, descriptions, and address lists were converted into shape files that can be overlaid onto Census geography.
5. Limiting the analysis sample to tracts in metropolitan areas with full geographic coverage (N = 92 metropolitan areas) produces substantively consistent results (available upon request).
6. Our sample includes open enrollment schools that draw from multiple neighbourhoods. According to SABS, about 6% of schools are open enrollment, though the quality of this indicator is poor. Excluding open enrollment schools from the sample does not substantively change results.
7. We consider LEP and GATE as rough proxies for peer ability, though selection into GATE is influenced by school and parent practices. School proficiency test scores also measure peer ability.
8. EDFacts masks the exact proficiency rate for small student populations, instead providing ranges (e.g. for schools with 31–60 4th graders, data indicate whether <10%, 11–19%, etc. were proficient). For schools where a range was provided rather than a precise value, we assigned the midpoint value.
9. Greenwald et al. indicates that an additional US$12,500 in teacher salary corresponds to an increase in achievement of 0.16 standard deviations. In 2013 dollars, this is approximately US$20,225. Dividing the difference in
A difference of US$2203 in teacher salary translates to a 2% standard deviation increase (0.11 * 0.16 = 0.027). US$2203 corresponds to about a 4% difference in salary across high- and low-income neighbourhoods, Loeb and Page estimate a 10% salary difference corresponds to a 3–4% difference in graduation rates.

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### Appendix

#### Table A1. Socioeconomic characteristics of neighborhoods by income quintile.

| Neighborhood income quintile | 1    | 2    | 3    | 4    | 5    |
|------------------------------|------|------|------|------|------|
| Poverty rate                 | 33.74% | 19.47% | 13.12% | 8.94% | 5.43% |
| Unemployment rate            | 14.35% | 10.10% | 8.11%  | 6.80% | 5.36% |
| Welfare rate                 | 6.12%  | 3.61%  | 2.53%  | 1.82% | 1.15% |
| Female-headed families rate  | 47.19% | 33.83% | 26.07% | 19.84%| 13.20%|
| Percent without high school degree | 25.05% | 17.48% | 12.38% | 8.65% | 4.89% |
| Percent with BA or more      | 16.46% | 22.52% | 28.76% | 35.84%| 50.93%|

Notes: Unemployment rate for civilian workforce over 16 years old; Educational attainment for population over 25 years old.
Table A2. Demographic characteristics of metropolitan areas in the study ($N = 378$).

|                           | Mean     | SD   |
|----------------------------|----------|------|
| Percent white              | 70.34%   | 18.16% |
| Percent black              | 10.19%   | 10.73% |
| Percent Asian              | 3.04%    | 3.93%  |
| Percent Hispanic           | 13.21%   | 15.92% |
| Percent less than HS       | 12.59%   | 5.42%  |
| Percent BA or more         | 27.57%   | 8.84%  |
| Unemployment rate          | 8.12%    | 2.27%  |
| Poverty rate               | 15.67%   | 4.52%  |
| Population                 | 608,565  | 1,109,556 |

Notes: White, black and Asian refer to non-Hispanic persons.