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UNDERSTANDING THE IMPACT OF EDUCATIONAL AND NONEDUCATIONAL STRUCTURES OF OPPORTUNITY AND DISINVESTMENT ON STUDENTS OVERAGE FOR GRADE

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Dedication

To all Black and Brown young people who have systematically and regularly experienced the violent outcomes of harmful racialized power structures. We recognize the strength and resistance you possess to function in a system not made for you.

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Abstract

Students who are overage for their grade, generally due to being retained at one or more grade levels in school, are at increased risk for lower educational attainment. In some districts across the United States, as many as 90% of students overage for grade do not complete high school (Bowers, 2010). Educators, researchers, and policy makers may misunderstand factors related to students becoming overage for grade if they only focus on individual student characteristics without considering structural conditions of schools and neighborhoods that may impact student outcomes. Overage students are disproportionately Black and Latine across the United States and often live in racially segregated neighborhoods. A long history of disinvestment resulting in inequitable social and economic conditions, including inequities in access to a range of resources and services, characterize these racially segregated neighborhoods (Metzger et al., 2015). Inequity between and within school districts may reinforce inequitable social and economic conditions as lower-funded districts do not have access to the same resources as school districts with higher levels of funding. The purpose of this study, therefore, was to advance the understanding of the factors related to neighborhood and school structural disinvestment and students' risk for overage for grade. Additionally, this study addressed high school level characteristics that may promote high school completion for overage students. The aims of this study were threefold. Aim 1 focused on the context of place by examining the distribution of ninth grade Chicago Public School (CPS) overage students across Chicago neighborhoods, and indicated the extent to which noneducational structures of opportunity and disinvestment (e.g., affordable housing, home ownership, access to green space, and food security) were related to risk of grade retention. Given that inequity among school districts may reinforce macro conditions, Aim 2 focused on elementary school-level characteristics (e.g., school poverty and

school discipline) as they related to students who are overage for grade. Furthermore, schools as political, cultural, and ideologically reproductive spaces often serve as sites of resistance and can support Black and Latine students who are impacted by educational inequity. Aim 3 emphasized how and which schools resisted the effects of inequitable structures by advancing racial equity school climate and cultivating students' civic and political knowledge to support students who begin high school as overage and promote high school completion. The findings from this study suggested housing affordability, home ownership, school discipline rate, and school poverty rate were most strongly and persistently significant despite accounting for education related factors at the individual level, which means they were most directly tied to the probability of ending elementary school overage for grade. Furthermore, racial equity school climate was associated with stronger high school graduation rates for all students and found to be especially important for students who are overage. These findings provide education, neighborhood, and housing policy considerations at the federal, state, and district level.

Chapter 1: Introduction

Despite concerted efforts by educators, researchers, and policy makers to improve education attainment—with progress in recent years—student achievement and attainment remain among the most significant challenges for school districts across the United States. In 2017 alone, approximately 2.1 million students between the ages of 16 and 24 dropped out or were pushed-out[1] from high school in the United States (National Center for Education Statistics [NCES], 2019). Alarmingly, this number translates to an average of 5,750 students withdrawing from school per day. Students who are deemed "overage for grade" after having been required to repeat a grade have much higher incidences of withdrawing from school than students at-age for grade level. (Allensworth, 2005; Bowers, 2010; Roderick, 1994; Rumberger, 1995; Suh & Suh, 2007). Jimerson et al. (2002a) conducted a systematic review of 17 studies that examined students dropping out of high school. Jimerson et al. found grade retention to be the most powerful predictor of high school noncompletion, with students who repeated a grade being 2 to 11 times more likely to withdraw from school than nonretained students. Moreover, students held back in elementary and/or middle school had a higher chance of withdrawing from high school than their retained and nonretained peers in high school (Jimerson et al., 2002a). Extant studies also found overage retained students tended to face emotional distress associated with having to repeat a grade (Reschly & Christenson, 2013; C. M. Smith & Herzog, 2014) and significant hindrance to their self-esteem and self-competence (Crothers et al., 2010; Hill & Weiss, 2005; Peixoto et al., 2016).

[1] Many scholars have argued that students who withdraw from school do not drop out of school voluntarily, but are pushed out of schools through mechanisms related to structural and socioeconomic barriers, behavioral health challenges, pedagogical practices, and administrative procedures (e.g., disciplinary; Fine, 1991; Morris, 2016).

Education administrators and policy makers designed grade retention to, theoretically, identify and ideally support students who did not meet the academic or social qualifications to be promoted to the next grade level. Over time, the positive intent on grade retention has had the unintended consequence of increasing marginalization of students of color. Students who are overage for grade are disproportionately Black and Latine. Black and Latine students are more likely to live in neighborhoods characterized by concentrated poverty; experience chronic absenteeism, high suspensions, and course failures; and be pushed-out from school or considered high school nongraduates (Allensworth, 2005; Bowers, 2010; Cahill et al., 2006; DePaoli et al., 2018; Goodman, 2018; Hong & Raudenbush, 2005; Im et al., 2013; Mac Iver, 2010; NCES, 2021; Peguero et al., 2021; Roderick, 1994; Rumberger, 1995; Suh & Suh, 2007). This is not the first time a policy intended to support student achievement had the effect of negatively impacting Black and Latine students, exacerbating education inequity (DePaoli et al., 2018; Im et al., 2013; NCES, 2019; Tingle et al., 2012). The perpetual overrepresentation of Black and Latine students facing educational challenges exposes the educational and noneducational systems of racial inequity.

Chicago Public Schools

Close to 9,000 elementary students, just over 4% of elementary students in the Chicago Public Schools (CPS), repeated one or more grades and, consequently, became overage for grade in 2014 alone (Chicago Public Schools, 2014). Each year, an estimated 2,000 overage for grade CPS students district-wide (over 7% of eighth grade student population) are at risk of not meeting eighth grade promotion criteria and enter high school as overage ninth graders (Age

Cycle 15[2]) with a significantly high risk of being off-track and/or withdrawing from high school (Chicago Public Schools, 2014). Based on CPS retention policy, students must meet minimum test score, attendance, and grade requirements to be promoted without mandatory summer school. Extant literature has shown living in historically disadvantaged neighborhoods or attending underresourced schools exacerbate student level risk factors for retention. For example, the Chicago neighborhoods with the highest concentration of students that enter high school as overage freshmen tend to be on the west and south sides of Chicago (Chicago Public Schools, 2014), which are historically racialized assignments of urban space for Black and Latine young people. Thus, it is important to examine how specific neighborhood and school structures increase the probability of students becoming overage for grade.

Most efforts to respond to the overage student occurrence have focused on individual characteristics of students (Jimerson et al., 2006), with relatively little attention to addressing system-level characteristics related to perpetuating inequities. This study built on a growing body of social justice-oriented research concerned with the systemic influences of opportunity structures and disinvestment, which I define as the patterns, options, supports, and access to resources that shape the opportunities for young people (Astor et al., 2021; P. L. Carter & Welner, 2013). Specifically, this study examined the impact of educational (e.g., institutions, schools) and noneducational (e.g., place, neighborhoods) opportunity structures and lack of investment or disinvestment on the odds of being overage for grade.

[2] Age Cycle 15 students are elementary school students who are 15 years old or will be 15 years old by September 1st of the following school year and, therefore, will become high school students whether or not they have met eighth grade promotion criteria.

Noneducational Opportunities and Disinvestment Place

The lived experiences of economically disadvantaged Black and Latine students are shaped by structural violence. Galtung (1969) coined and described the term structural violence as social structures—economic, political, legal—that perpetuate relations of power, privilege, and inequity and prevent individuals and communities from receiving their basic needs. Such social arrangements are embedded in the organization of the social world resulting in inequitable distributions of access and opportunity to resources, housing, education, health care, and political power. One example of a system of discrimination inbuilt in a social structure is the 1930s Home Owners Loan Corporation (HOLC) map commissioned by the Franklin Roosevelt administration as part of The New Deal in response to housing foreclosures in wake of the Great Depression. Through the HOLC, the Franklin Roosevelt administration created racialized residential maps that redlined 239 cities to identify urban areas that were attractive for government-backed investment and economic development. This redlining process ultimately shut out Black, Brown, and immigrant residents and cemented the concentration of urban disadvantage—characterized by racial segregation, poverty, unemployment, welfare receipt, and female-headed households (Guttentag & Wachter, 1980; Massey, 1990; Sampson, 2013; Wilson, 1987).

Furthermore, a culmination of racist practices, such as the use of restrictive covenants and social and economic disinvestment (i.e., infrequent garbage pickup and overcrowded housing) contributed to the formation of high-burden neighborhoods. These high-burden neighborhoods experienced concentrated disadvantage and limited access to resources, such as secure and stable housing, grocery stores, well-resourced schools, and health services (Henry et al., 2014; Sampson et al., 2008; Sharkey, 2013). An interdisciplinary body of research has shown neighborhood context especially impacts young Black and Brown people (Bowers, 2010;

Roderick, 1994; Rumberger, 1995; Suh & Suh, 2007). Neighborhoods with concentrated poverty and disadvantage have also been associated with negative outcomes such as behavioral health challenges, suspensions, and chronic absenteeism, all of which are prevalent indicators for not completing high school (Rumberger, 2010). Given that a high percentage of overage students fall into similar demographics of becoming high school nongraduates, this study examined the extent to which the context of neighborhood structural disinvestment and opportunities, embedded in persistent racial inequity, is associated with the odds of being overage for grade. Understanding and illuminating both the structural assets and inequities in a young person's context related to education outcomes can inform policy and practice solutions, including those at the systemic level.

Educational Opportunities and Disinvestments

Because systemic racism impacts meso-level organizations, such as schools, organizations can perpetuate racial inequities in social and academic outcomes for Black and Latine students (Ray, 2019). Thus, understanding how schools impact or disrupt mechanisms of racial inequities, particularly for overage students, is critical. Schools represent a system that can help disrupt or diminish the effects of neighborhood structural disinvestment. Many schools in high-burden urban communities, however, are constrained by the absence of financial resources needed to provide necessary supports and services to students (e.g., additional academic supports, access to school counselors/social workers). Researchers have documented the strong relation between residential segregation and the concentration of poverty and dearth of essential neighborhood resources (Orfield, 1997; Williams & Collins, 2001). Neighborhood resources significantly influence the quality of neighborhood schools, and attendance zones significantly impact the racial demographics of schools because they often mirror racially and

socioeconomically segregated neighborhoods (Siegel-Hawley, 2014). Despite reform policies, such as school choice models in high-poverty districts, Simms and Talbert (2019) demonstrated how reforms do not adequately account for the ways racism and residential segregation fundamentally shape the distribution of well-resourced schools in their jurisdictions. Simms and Talbert found school choice programs further intensified racial inequity particularly among Black families, and did not remedy the resource imbalance between Black and white communities. Specifically, school choice has imposed a "parenting tax" on Black parents because they expend resources such as time, effort, and emotional cost not incurred by most white parents and parents who sent their children to neighborhood schools. Additionally, given entrenched racial residential segregation, Black parents have experienced greater challenges to obtain a high-quality school and a reliable support system in the same geographic area. Furthermore, compared with schools in middle- and upper-class neighborhoods, segregated schools across districts have been generally associated with inequitable funding and resources, which have been associated with lower average test scores, higher pushout rates, and disproportionately targeted for school closures (Darling-Hammond, 2007; Ewing, 2018; NCES, 2011; Rice & Croninger, 2005). Drawing on the tenets of racialized organizational theory (Ray, 2019), this study integrated the framework that assumes no institution functions as race neutral or free of a racialized system. This study addressed the extent to which the context of educational opportunities and school experiences shaped and related to the experience of students who are overage for grade. Additionally, this study presented the variation of risk between educational (e.g., elementary schools) and noneducational (e.g., neighborhoods) contexts on the odds of being overage for grade.

High school educators and policy makers can resist the effects of inequitable structures and serve as advocates to promote high school completion and support students who begin high school as overage. Specifically, studies have shown both positive school climate and schools' promotion of student civic engagement are pathways to student engagement and connection to school, and may serve as buffers against the effects of social, economic, and academic challenges as well as high school noncompletion (Geller et al., 2013; Mahoney & Cairns, 1997; Putnam, 2015; Voight et al., 2020). Studies have found school curricula that include ways to cultivate students' civic and political knowledge, uncovering the histories, policies, social issues, and movements that contribute to and resist injustice and marginalization in students' communities, relate to the educational success of Black and Latine young people (Collins, 1990; Paris & Alim, 2017; Sondel et al., 2018). Additionally, Geller et al. (2013) found perceptions of equitable school climate, such as consistency and fairness of school rules, were positively associated with positive civic behaviors and academic outcomes. This study examined the extent to which perceptions of equitable school climate and schools' promotion of student civic engagement served as factors promotive of high school completion for overage students.

Specific Aims

The overall aim of this project was to examine where students who are overage for grade were concentrated, the extent to which risk of grade retention was related to the neighborhood students live in, and how much of that risk was mediated by the schools they attended. Knowing the distribution of overage students in neighborhoods and schools helps identify where changes are needed. If the majority of overage students are in specific schools and neighborhoods, school districts and policy makers can focus on neighborhood and school-wide supports. Separating school and neighborhood influences helps identify schools in need of resources and better serve

communities, while knowing the characteristics of neighborhoods and schools with higher grade retention rates could point to potential mechanisms for preventing grade retention. Furthermore, examining elementary and high school level influences help identify the extent to which school practices make a difference. This study aimed to advance a structural understanding of opportunity and lack of investment or disinvestment at multiple ecological levels by examining the following research questions:

1) Neighborhood Level

   Aim 1: Learn who is most at risk of being retained in grade and how that risk is related to neighborhood disinvestment and assets.

   1a. In which census tracts are CPS overage students entering ninth grade most concentrated?

   1b. Which neighborhood characteristics of assets and disinvestment are most related to the probability of being overage for grade? Such assets and disinvestment may be socioeconomic (i.e., neighborhood poverty), housing (i.e., home and rental affordability, home ownership rates), or social and institutional supports (i.e., access to supermarket and green space).

   1c. Do characteristics of identity such as race or sex relate to the probability of being overage for grade within and between neighborhoods? For instance, do neighborhoods with high proportions of Latine students have higher odds of students being overage for grade compared to neighborhoods with high proportions of white students (between effects)? When controlling for racial composition within the neighborhood, does a Latine student have higher odds of being overage for grade (within effects)?

2) Elementary Schools

Aim 2: How is risk of being retained related to elementary school characteristics?

2a. Which school characteristics (i.e., school poverty rate, school suspension rate, student–teacher trust, school safety) are linked to the probability of students being overage for grade?

2b. Do characteristics of identity such as race or sex relate to the probability of being overage for grade within and between elementary schools?

2c. How much variation of risk is explained by elementary school level and how much is explained by neighborhood level?

3) High Schools

Aim 3: Which school characteristics relate to high school completion for students who begin high school as overage for grade?

3a. Do civic engagement and racial equity climate in schools promote high school completion for overage students?

3b. Do they reduce the difference in graduation rates for retained students compared to students at grade level differentially based on race and sex?

Background and Significance

Overage for Grade

Being overage for grade level is defined as a student who is older than their cohort peers or whose age is outside the official school-age range for that grade level (Grant et al., 2014). Most students who are overage for grade were retained in grade at one or more points in school, although a small percentage of students began school after age 5. The decision to retain a student in grade is primarily based on at least one or a combination of performance on benchmark statewide assessments, grades, attendance, and performance on other academic or social-behavioral indicators determined by the school district. In some occurrences, teachers recommended retaining a student based on their perception of the student's performance; however, scholars have argued teacher discretion can be harmful given the bias of teacher expectations and their perceptions toward student abilities (Hughes et al., 2001; Pianta et al., 1995). For instance, Hughes et al. (2005) attributed teacher bias, perception, and varying expectations for Black students compared to white students to disparity in retention among Black students. Furthermore, students who had a negative relationship with their teachers were more likely to be retained (Hughes et al., 2001; Pianta et al., 1995). Regardless of the varying catalysts that endorsed students to become overage for grade, the underlying belief was an additional year of instruction would provide the opportunity for students to improve their academic skills, and would ultimately address the disparities in academic trajectories for various subgroups such as English language learners; students in special education; low-income students; and Black, Latine, and other students of color (R. T. Jacob et al., 2004; No Child Left Behind [NCLB], 2002).

Overage for Grade in the Context of Federal, State, and District Education Policy

The decision to promote or hold back students in grade due to academic performance has varied considerably over time and remains to be one of the most contentious and inconclusive topics in education. In the 1960s, educators were concerned about the negative impacts of grade retention on students' social-emotional and cognitive development. This concern led to a push for social promotion, which allowed students to advance to the next grade level despite their academic performance (B. A. Jacob & Lefgren, 2009). In the wake of standards-based reforms, Chicago officially put an end to social promotion in 1996. More states followed in the advent of the NCLB Act of 2001, which increased rates of overage retained students nationwide (Nagaoka & Roderick, 2004; Roderick et al., 2005).

In response to what was perceived as the continued failure of the public education system to educate all students to high standards, President George W. Bush signed the NCLB Act of 2001, which required states to adopt standards-based accountability systems. NCLB is a reauthorization of the Elementary and Secondary Education Act (ESEA) of 1965, signed by President Lyndon Johnson. ESEA created a role for the federal government to oversee K–12 education policy decisions and, as part of the government's antipoverty focus, allocated over $1 billion a year in aid (known as Title I) for school districts to support their most disadvantaged students. Through NCLB, the government expanded the federal role in education and strengthened Title I accountability, which required states to implement a system of mandated annual testing that would assess performance of all students enrolled in third to eighth grades. Conversely, students who failed to master standards on these assessments were retained in grade to, theoretically, gain the academic skills they needed (Powell, 2010).

The federal push for greater accountability added another set of pressures to which schools needed to respond and demonstrated to be further problematic for school districts, educators, students, and communities (Powell, 2010). First, the government offered federal school funding under the condition that schools would fulfill extensive accountability requirements (NCLB, 2002). One study focused on the cost of fully implementing and reaching the NCLB mandate in Ohio and found the state would have to spend an additional $1.5 billion on education each year to meet NCLB's accountability requirements (New America Education Policy, 2016). Many schools did not meet NCLB's achievement targets, and by 2011 school failure rates were above 50% across several states (Klein, 2015).

Second, the overemphasis on standardized testing forced educators to focus time toward math and reading curricula rather than incorporate subjects that have been shown to support student engagement and overall achievement, such as social studies, civic engagement, and the arts (Geller et al., 2013; Paris & Alim, 2017; Woodson, 2015). Third, the government required most underresourced and racially segregated schools to increase academic standards without the proper resources and support. Yet, the government evaluated schools on the same metrics, which caused underresourced and racially segregated schools to fail to satisfy the expectations of state standards (Stone & Engel, 2007). Under NCLB, if schools did not meet state standards for 2 or more years, known as adequate yearly progress, schools were subjected to turnaround strategies that included removing the principal and/or school staff, converting to a charter school, or eventual school closures (Klein, 2015), which disproportionately impacted economically and racially segregated schools and neighborhoods (Ewing, 2018).

The pressures of NCLB ultimately led to sacrificial choices against the most vulnerable students including students who historically and systematically had the least access to resources.

For instance, the U.S. Department of Education Office for Civil Rights (2012) revealed students most impacted by grade retentions were students living in poverty, English as a second language learners, students in special education, and Black and Latine students. The belief that holding back students in grade would be academically beneficial coupled with the strict mandates of NCLB resulted in the paradox of leaving the most vulnerable students behind, subsequently increasing the number of "academically behind" students amid the NCLB Act of 2001 (Jimerson et al., 2006).

President Barack Obama offered states a waiver from the strict mandates of NCLB through the Every Student Succeeds Act (ESSA) signed in 2015—a reauthorization of the NCLB. Although the ESSA still required student testing, the purpose of ESSA was to give states more discretion on how they administered the test and to provide flexibility in meeting the standards set by the federal government, essentially shifting the responsibility of implementation from the federal government to the state (Edgerton, 2019). For instance, many states adopted common core testing—standards that indicate college readiness—and designed assessments to measure student progress and meet accountability standards (NCES, 2021). Although an improvement from the accountability restrictions of the NCLB, ESSA continued to rely on testing to create accountability outcomes; its effectiveness to measure student success or failure has remained controversial (NCES, 2021).

Social Promotion and Effects of Grade Retention

In most cases, it is difficult to determine whether students would have fared better if educators promoted them to the next grade instead of retaining them. Retention researchers who compared groups of promoted students suggested students whom educators retained were either at a disadvantage or fared no better than promoted students, while other researchers

demonstrated short-term positive effects that faded over time (McCoy & Reynolds, 1999; Roderick & Nagaoka, 2005). Extant evidence has suggested grade retention may not be an ideal strategy to support students who are academically behind (Allensworth, 2004; Hong & Raudenbush, 2005; Nagaoka & Roderick, 2004). Grade retention has been associated with more negative than positive outcomes for students, including significant disengagement in school, negative impact on one's social-emotional development, and eventual high school noncompletion (Allensworth, 2004; Bali et al., 2005; R. T. Jacob et al., 2004; Jimerson et al., 2006). Holmes and Matthews (1984) reviewed 44 studies that showed promoted students exhibited higher academic performance and more positive attitudes toward school than retained students. Roderick and Nagaoka (2005) examined the effects of Chicago's high stakes testing program for third, sixth, and eighth graders in comparison to students who missed the promotion cutoff. Roderick and Nagaoka's findings suggested sixth graders whom educators did not promote showed lower academic growth relative to those whom educators promoted. Additionally, Roderick and Nagaoka found no evidence that retention led to greater achievement growth for third graders. Allensworth (2004) evaluated Chicago Public Schools' efforts to end social promotion and found students whom educators held back at the eighth grade promotional gate increased low-achieving students' likelihood of not completing high school.

Holmes (1989), McCoy and Reynolds (1999), and Roderick and Nagaoka (2005) found small positive gains in academic performance for students whom educators held back in comparison to students whom educators promoted. However, these gains reversed or diminished 2 to 3 years after the baseline year, and the risk of dropout became apparent as students increased in age. Holmes (1989), in a meta-analysis of 63 studies, found schools with positive findings often used a system of early identification of students at risk of being retained and provided

additional supports through individualized education plans, continuous evaluation of academic performance, and low student–teacher ratios. For instance, Peterson et al. (1987) followed a cohort of students in the Mesa Public Schools in California, where schools provided early identification and individual education plans for at-risk and retained students. Peterson et al. found positive academic effects for retained students, however, gains diminished in subsequent years. These findings demonstrated value in providing students at risk of retention with additional individualized support and continuous evaluation throughout their academic trajectory rather than merely recycling students through the same curriculum.

Jimerson (2001) examined multiple studies between 1990 and 1999 that found no significant achievement differences between promoted and retained students. Many studies, however, documented the effects of being overage for grade that go beyond academic outcomes (Browman, 2005; Jimerson et al., 2002b). Nagaoka and Roderick (2004), for instance, found a 20% increase of students placed in special education during their retained year. Furthermore, overage retained students tended to face significant hindrance to their self-esteem (Crothers et al., 2010; Hill & Weiss, 2005), and experience feelings of incompetence (Peixoto et al., 2016) and emotional distress associated with having to repeat a grade (Reschly & Christenson, 2013; C. M. Smith & Herzog, 2014). Third grade students rated grade repetition as the third most stressful event behind the loss of a parent and going blind (Anderson et al., 2002). Research has also suggested students whom are overage for grade need additional social and emotional support (Reed & Kirkpatrick, 1998) and considerable supplementary services (Hong & Yu, 2007; Jimerson et al., 2006). Although few studies have shown positive social-emotional effects of retaining a student in grade (e.g., Im et al., 2013; Wu et al., 2010), scholars have also suggested the gains associated with grade retention can be temporary (Jimerson et al., 2002a). Cham et al.

(2015) suggested even if overage students did not experience socioemotional consequences they were still at risk of not completing high school.

Effect on the Propensity to Not Complete High School

One of the most prevalent and consistent findings in research conducted on students overage for grade is students were most at risk to not complete high school and have almost double the dropout rate relative to those who were at age for grade level (Allensworth, 2004; Jimerson et al., 2006; Roderick, 1994). Bowers (2010) found 90% of overage students did not complete high school. Moreover, students held back two or more grades—especially those who had already been retained prior to third grade, which made them two grade levels behind their peers—had a drastically higher chance of withdrawing from school (Jimerson, 1999; Jimerson et al., 2002a). As early as 1987, Mann demonstrated that students who were retained in one grade were 40% to 50% more likely to not complete school than students at grade level, and students who fell two or more grades behind their grade level had an alarming 10% chance of graduating high school (Mann, 1987). The Alliance for Excellent Education (2011) reported 93% of New York City nongraduates were at least 2 years off track in school, which classified them as overage for their grade. Moreover, the decision to retain students in elementary and middle school had serious consequences. Rumberger and Lim (2008) reviewed 50 studies over the span of 25 years that examined dropping out. Rumberger and Lim documented 37 studies that found retention in elementary and/or middle school dramatically increased the odds of withdrawing from high school. Similarly, Roderick (1994) found overage students retained between kindergarten and eighth grade were twice as likely to not complete high school. B. A. Jacob and Lefgren (2009) found younger eighth graders whom educators retained in Chicago Public Schools (CPS) were 22% more likely to withdraw from high school, whereas B. A. Jacob and

Lefgren found no significant increase in the probability of older retained eighth graders leaving high school. B. A. Jacob and Lefgren suggested the nonsignificant findings for older retained eighth graders may be due to educators who sent older students to transition centers that provided them opportunities to catch up academically. The magnitude of not completing high school was also detrimental in other life outcomes. For instance, Lansford et al. (2016) found adults without a high school degree were up to 4 times more likely to experience arrest, employment termination, government assistance, illicit substance use, or poor health by age 27, and 24 times more likely to experience as many as four or more of those negative outcomes compared to high school graduates.

Academic and Nonacademic Predictors

Research has suggested grade retention does not happen in a vacuum. Researchers found becoming overage for grade related to a range of risk factors and disadvantage (Browman, 2005; Hong & Yu, 2007; Jimerson et al., 2002a). For instance, young people face circumstances that can put them at greater risk of becoming overage for grade, such as school and housing mobility, homelessness, and living in concentrated poverty. The New York City Department of Education (NYCDOE) estimated roughly 25% of overage students had been homeless or identified as living in temporary or unstable housing (Decker, 2012).

Furthermore, young people with poor attendance or high suspensions were much more likely to become overage retained students (Grant et al., 2014). Christle et al. (2004) found a high correlation between suspension rates and retention rates. Weiss (2008) documented subsequent absences for students whom educators suspended often contributed to grade retention, alluding to the difficulty of being able to catch up academically. Researchers recommended differentiating between excused and unexcused absences and suspensions, finding

effects exacerbated when examining unexcused absences (Gottfried, 2011, 2013). Baltimore Education Research Consortium conducted a study that found 50% of students whom withdrew from school were suspended at least once in the 3 years prior to leaving (Mac Iver, 2010). Hess et al. (1989) used absence patterns to identify 90% of Chicago high school nongraduates. School discipline policies indirectly contributed to absenteeism, grade retention, and nongraduates by instructing educators to (a) respond to student needs with punitive action,[3] and (b) remove students from school without providing the appropriate support they need to stay on track and at-age for grade level (Rumberger, 2010). Students overage for grade have faced a myriad of challenges even prior to getting retained, and without the appropriate institutional supports, schools risk the unintended consequence of either pushing them or losing them from the school system.

Retention Rates for Students Who Identify as Black and Latine

Retention decisions disproportionately impact Black and Latine students as Black and Latine students are most represented among students overage for grade. The National Center for Education Statistics report, *Status and trends in the education of racial and ethnic groups 2016*, showed the percentage of students retained in grade decreased from 3.1% to 1.9% between 2000 and 2016. However, despite making up 38.4% of U.S. school-age children, Black and Latine students retained across the years remained at a higher percentage relative to white students retained (de Brey et al., 2019). The combined enrollment of Black and Latine was 43% compared to white student enrollment at 46% (U.S. Department of Education, 2020). The rate of Black students held back a grade in elementary or high school was 1 in 5, compared to the

[3] Punitive action alludes to the carceral trajectory that impacts young people of color through carceral logics (i.e., punitive decisions, policies, and practices that contribute to the school prison nexus).

overall retention rate of 1 in 10 (P. L. Carter & Welner, 2013). On average, students of color were retained 1.5 times more frequently than white students (Musu-Gillette et al., 2017). Musu-Gillette et al. (2016) found educators retained Black and Latine students in the same grade at 3% and 2.9% compared to 1.8% of white students.

The overrepresentation of young Black and Latine people in retention rates is of grave concern given the host of related challenges, such as negative impacts on social-emotional health, an increased probability of not completing high school, and an increased risk of interacting with the criminal legal system (Grant et al., 2014). Furthermore, retention in grade does not increase achievement levels (Nagaoka & Roderick, 2004). The high prevalence of overage students becoming high school nongraduates exposes the self-perpetuating system of racial inequity as nongraduates, including overage students, continue to be disproportionately Black and Latine (Hynes, 2014; NCES, 2019).

The self-perpetuating system of racial inequity within education also sheds light on the intertwined racialized systems that impact the future of young Black and Latine people, such as the legal system. For instance, nongraduates are 3.5 times more likely to become incarcerated than high school graduates and, when viewed along racialized lines, Black and Latine students continue to be disproportionately undereducated and overincarcerated (Ludwig & Shah, 2014; NCES, 2019; C. D. Smith, 2009). For a student who is overage for grade, completing high school becomes imperative in this context, especially for Black and Latine students. Ultimately, there is concern that former- and present-day education policymakers make limited effort to address the root causes of educational inequity, including the disproportionate burden of risk of grade retention and overage for grade that affects young Black and Latine people.

Chapter 2: Theoretical and Conceptual Foundation and Literature Review

Theoretical and Conceptual Frameworks

This section addresses the key conceptual and theoretical frameworks that guided this study. To understand the experiences of students overage for grade, this study used a social epidemiology and critical quantitative approach. The transformative racial equity framework—an extension of the ecological systems perspective with each ecological level grounded in distinctive theories, such as critical race, racialized organization, and resistance theories—informed the theoretical and conceptual framing, provided context for the analyzed constructs, and guided the interpretation of the study results.

Using a Social Epidemiology and Critical Quantitative Approach

This study focused on the issue of students overage for grade using a public health perspective and a social epidemiological lens. Epidemiologists aim to identify a rapid spread of a disease that affects a large number of people in a community or region, or specific populations most at risk. Social epidemiologists, in particular, aim to identify the social structures and institutions that affect the pattern of disease and health distributions. Social epidemiologists also believe solutions at the population level, rather than focusing only on individual treatments, are necessary to disrupt patterns of disease (Krieger, 2001). This social epidemiology perspective considers the structural determinants that shape the patterns that lead to adverse health outcomes. Scholars can adapt and apply this same perspective to other outcomes, such as education, to provide new insight into the causes of and potential means to address risk for students overage for grade. In particular, conceptualizing the issue of overage students through the lens of social epidemiology provides a conceptually and practically useful framework for moving away from a

sole focus on the individual characteristics of overage students and including attention to the root causes of the creation of students overage for grade.

Historically, government officials disproportionately invested in white communities, while divested Black and Latine communities (Sharkey, 2013). Structural disinvestment represent risk that can show up in various ways. For example, lack of access to stable and affordable housing can shape a young person's experience with and engagement in school. If a young person is not engaged in school or has poor attendance, retention policies require holding back the student in grade as opposed to targeting the unequal inputs such as housing and rental affordability that may have helped create educational related challenges, thus contributing to a population of students overage for grade. This study used a social epidemiology perspective to help educators, researchers, and policy makers to understand the population prevalence at every level (i.e., neighborhood, schools, and the predictors of these things) and to determine whom is at risk, under what conditions they are at risk, and what structural disinvestment/lack of investment and opportunities shape population at the structural level. This social epidemiology perspective addresses systems and structures to inform policy or systems-level practice intervention.

Critical race scholars in education have argued the perpetual racial inequities present in educational institutions that disproportionately impact Black and Latine young people requires scholars to bring race and racism to the center of their scholarship (Tate, 1997). Because most works based in critical race theory have been theoretical or qualitative, critical quantitative researchers have pushed to enhance the robustness of critical quantitative methods—QuantCrit—to encourage the framing, interpretation, and methodological tools that address historical and structural racism, sociopolitical and economic factors, and geographical spaces that perpetuate racial inequities in both processes and outcomes (Garcia et al., 2018; Gillborn et al., 2017;

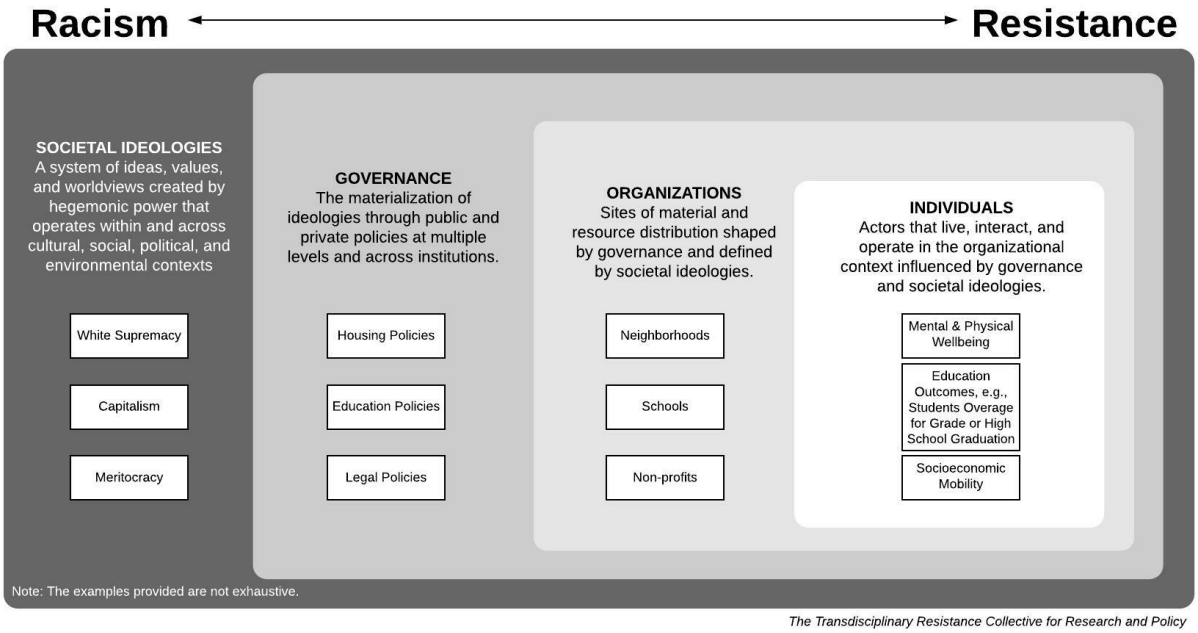
Strunk & Betties, 2019). The present study used a critical quantitative approach guided by the transformative racial equity framework (described in the next section) to frame, theorize, and interpret the issue of students overage for grade from a systemic perspective. The study also used a place-based approach through geographic information system (GIS) mapping and multilevel modeling to address how inequity manifests geographically, and how the distribution of students overage for grade is associated with present-day unequal inputs of opportunity and disinvestment. A critical quantitative approach examines not only how racialized oppression and inequity manifest geographically (Morrison et al., 2017; Solórzano & Velez, 2016), but also elucidates the assets of communities of color and schools located in neighborhoods that have experienced disinvestment (Solórzano & Bernal, 2001). Furthermore, interpreting the study findings in connection to historical and present-day racial inequities can help counter efforts to explain away the effects of systemic factors on education outcomes based solely on reductionist or individualistic risk factors.

Transformative Racial Equity Framework

The transformative racial equity framework (TREF) is an extension of the ecological systems perspective (Bronfenbrenner, 1994) and integrates a social justice approach to illuminate how multiple and complex layers of society including societal ideology, institutions, organizations, and individuals embed education inequity (see Figure 2.1; The Transdisciplinary Resistance Collective for Research and Policy et al., 2020).

Figure 2.1

Transformative Racial Equity Framework



Note. Adapted from "Building the Transdisciplinary Resistance Collective For Research And Policy: Implications for Dismantling Structural Racism as a Determinant of Health Inequity," by The Transdisciplinary Resistance Collective for Research and Policy, S. Irsheid, A. N. Neely, A. S. Ivey, C. Duarte, & J. Poe, 2020, *Ethnicity & Disease, 30*(3), 385 (https://doi.org/10.18865/ed.30.3.381). Printed with permission. All rights reserved.

Distinct from the ecological systems framework (Bronfenbrenner, 1989), each level in the multilevel TREF model is grounded in distinctive theories, including critical race, racial state, racialized organization, and resistance theories. The theories illustrate the permanence of racism as a structured system that interacts with institutions and organizations, both shaping and being reshaped by them, which in turn, systematically maintains, justifies, and perpetuates racialized hierarchies from the macro-level to the interpersonal-level, contributing to racial inequities (Ladson-Billings & Tate, 2016; Ray, 2019; Spencer, 2017; The Transdisciplinary Resistance Collective for Research and Policy et al., 2020). Furthermore, the TREF centers

racism and resistance across the multilevel systems as they influence ideologies and have a bidirectional relationship with each of the layers (The Transdisciplinary Resistance Collective for Research and Policy et al., 2020). Given that education inequities are affected by larger sociospatial inequities that intersect at the neighborhood, school, family, and individual levels, the TREF was used as a guide to inform the study's theoretical and conceptual framing of students overage for grade.

From the ecological systems perspective, multilevel systems and their bidirectional relationships, impact and shape the environments and lives of young people. Bronfenbrenner's (1989) ecological theory provides insight and a broad understanding of how it is almost impossible to conceptualize the individual in isolation from their context. Individuals and their environments simultaneously shape one another and interact in complex ways to influence outcomes (Bronfenbrenner, 1989). Furthermore, the individual is situated in a complex nested hierarchy of systems, which includes: (a) a microsystem, the most proximal setting in which the individual is directly influenced; (b) a mesosystem, defined as the interaction and relation between microsystems; (c) an exosystem, described as external social settings in which the individual is indirectly affected; (d) a macrosystem, which is the most distal setting comprised of cultural milieu; and (e) a chronosystem, defined as the change or continuity across time that influences other systems (Bornstein & Cheah, 2006; Bronfenbrenner, 1994). However, a critical limitation, and arguably a deficit, of the ecological systems framework is that it is ahistorical and apolitical as it does not explicitly name structural racism in the social and political environments that shape the racialized lived experiences of young people. Structural racism is a multilevel system of ideologies, institutions, and processes that has created, contributed to, and reified inequities for Black, Indigenous, Latine, and other people of color (Gee & Ford, 2011). As a

system, racism works in concert across and through institutions, policies, and practices that govern and shape society to build a concentration of wealth and access to resources in white communities, facilitating systematic disinvestment from Black, Indigenous, and Latine communities (Lipsitz, 2011). The culmination of these processes results in racially patterned distributions of opportunities and access, all of which are established determinants of well-being and academic success (Acevedo-Garcia et al., 2020; P. L. Carter & Welner, 2013). As an expansion of the ecological systems perspective, the TREF can help researchers elucidate how inequity, in this case education inequity and the disproportionate rate of Black and Latine overage students, is embedded in and across multiple layers of society, including societal ideology, institutions, organizations, and individuals.

The outer layer of the TREF encompasses societal ideologies, defined here as a system of ideas, values, and worldviews created by hegemonic power that operate in and across cultural, social, political, and environmental contexts (S. Hall, 2019). Guided by critical race theory (CRT), the outer layer of the TREF can be used to emphasize societal ideologies that undergird explanations for racialized education inequities. CRT acknowledges race as a social construct and offers insight on the multifaceted ways in which racism permeates societal institutions with consequences for distributions of education, health, and well-being (Bell, 1995; Bonilla-Silva, 2001). Despite CRT originating in legal studies, education scholars have integrated CRT in education research to uncover how dominant ideology prevails to advance and safeguard systemic white privilege and power in school systems, while framing the challenges disproportionately faced by Black, Indigenous, Latine, and other young people of color as deficiency and deviance rather than by policies and practices fostered by racial ideologies (Ladson-Billings & Tate, 2016). This critical framing serves to hold accountability for

individualized or deficit explanations that suggest young Black and Brown people are deficient, lacking, or engaging in behaviors that suggest they do not take their education serious based on reductionist risk factors. Or, in the case of this study, it encourages a move away from reductionist or deficit explanation of students who are overage for grade.

Governance also embeds racial ideologies. Presented as the second layer of the framework, governance is defined in the TREF as the materialization of societal ideologies through private or public policy, practices, and funding structures that enforce the racial politics of everyday life (The Transdisciplinary Resistance Collective for Research and Policy et al., 2020). Racial state theory guides the second layer and asserts the state plays a centrally important role in determining which racial groups benefit and which the state excludes from its protection (Goldberg, 2001). Racial ideologies that have been historically and systematically embedded in policies and practices such as racial housing segregation, school funding practices, or education policies (i.e., No Child Left Behind [NCLB] Act of 2001) have contributed to the creation of conditions such as racially segregated and high burden neighborhoods, underresourced racially segregated schools, and failing schools. Policies that justify racialized inequitable practices essentially influence which neighborhoods are divested from and which communities and schools get access to resources. Thus, the geographical concentration of Black and Latine overage students whom are disproportionately impacted will be considered in the context of policies and practices that have produced inequitable distributions of access and opportunity for Black and Latine communities. Specifically, this study used the 1930s HOLC redlining map, which prevented access to secure housing and shifted economic capital away from Black and Brown communities, to examine how the redlining map overlays with the distribution of overage students across the city of Chicago (see Appendix A). This study also examined neighborhood

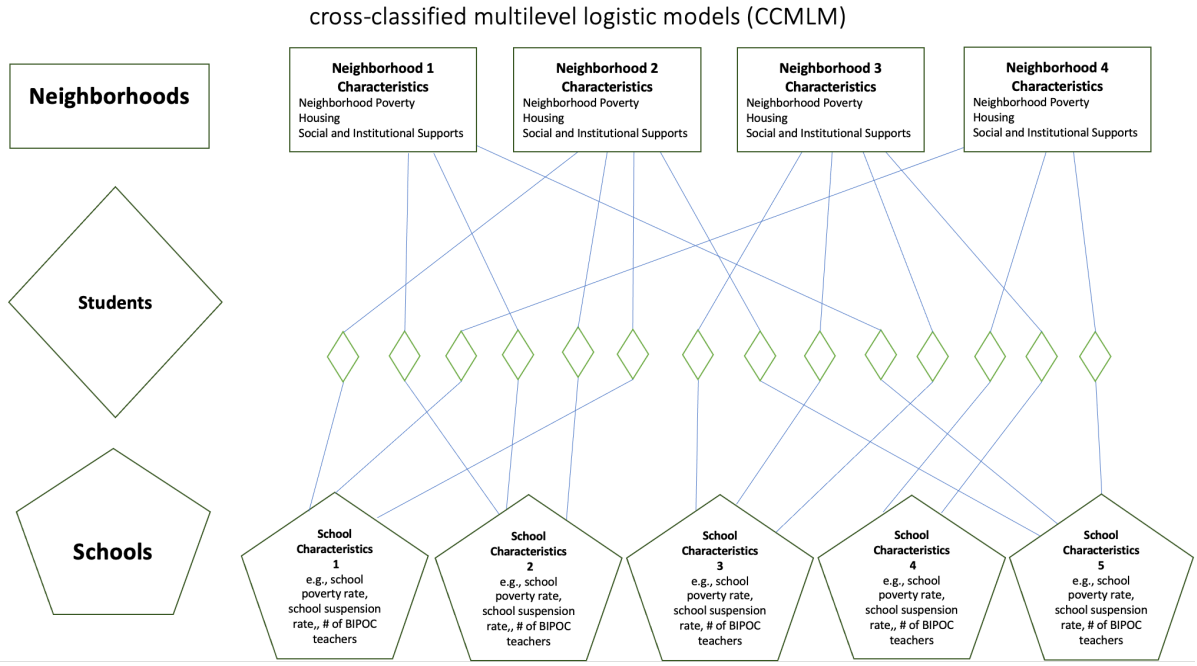
factors that underscore structural disinvestment and opportunities as they relate to students overage for grade.

Neighborhoods and schools lie at the organization level or third layer of the TREF. The organization level is defined as sites of material and resource distribution shaped by governance (i.e., second layer) and by societal ideologies (i.e., outer layer) that shape life outcomes for young people. Because governance regulates the distribution of organizational resources, racialized organization theory guides the next layer of the framework. Racialized organization theory contends that organizations (e.g., neighborhoods, schools) are racial structures that legitimize the unequal distribution of resources and reproduce the racial hierarchies that exist between one another (e.g., high burden racially segregated neighborhoods and schools are disadvantaged and underresourced relative to high resourced neighborhoods and schools; Ray, 2019). This racialized process through policy and governance influences (a) from which neighborhoods and schools the state divests and (b) how the state characterizes neighborhoods and schools by inequities such as school poverty, limited access to affordable and stable housing, food access zones, and quality educational resources. The TREF provides a framework to examine prominent neighborhood- and school-level factors that have been established in school and neighborhood effects research that underscore structural disinvestment and opportunities and their possible association with the odds of being overage. Further, the confluence of being impacted across these multilevel systems dramatically increases the vulnerability of young people to become disengaged from school, experience high number of school absences, become overage for grade, and eventually leave or get pushed out of high school. Thus, the TREF guided this study's examination of the intersection of neighborhood and schools and their association with the odds of being overage for grade. Figure 2.2 illustrates how this looks in a multilevel

modeling context, as it examines the variation of risk explained by the neighborhood and elementary school level.

Figure 2.2

Cross-Classified Multilevel Logistics Model



The TREF offers insight on oppressive processes and inequitable patterns and acknowledges resistance expressed through individual, collective, or institutional action (Solórzano & Bernal, 2001). As resistance theory holds, Black, Indigenous, Latine, and other communities of color not only resist normalized dynamics but organize for policy-level interventions that reimagine schools and community (e.g., defunding the police campaign that are in service of education equity; Solórzano & Bernal, 2001). Furthermore, schools as political, cultural, and ideologically reproductive spaces often serve as sites of resistance and can support

Black and Brown students whom educational inequity impacts. For instance, because a young person's racialized lived experience can impact their identity and development, making meaning of these racialized structural inequities facilitated through the school curriculum or positive racial school climate may have crucial implications on a young person's outcomes and overall success. The TREF guided the examination of how and which schools simultaneously resist imposed structures of power and become advocates for students overage for grade, specifically through the possibility of advancing racial equity school climate and cultivating students' civic and political knowledge.

Literature Review

This study builds on a growing body of social justice-oriented research that examines the systemic influences of opportunity structures and disinvestment, which I define as the patterns, options, supports, and access to resources that shape the opportunities for young people (Astor et al., 2021; P. L. Carter & Welner, 2013). In this section, I review key literature that supported the conceptualization of this study and guided the examined indicators. Specifically, this section examines existing literature on characteristics that typify noneducational (e.g., place, neighborhoods) and educational (e.g., institutions, schools) opportunity structures and lack of investment or disinvestment that impact educational outcomes.

Education Debt

Ladson-Billings (2006) was one of the first scholars to bring the tenets of critical race theory into education scholarship by highlighting the extent that systemic racism underpins education inequities. Ladson-Billings contended the United States has had an education debt that culminated through harmful policy and practice and impacted Black, Indigenous, and other people of color (BIPOC), making the education debt raced, classed, and perpetuated by white

supremacy (Ladson-Billings, 2006). Ladson-Billings argued for scholars to examine the ways historical and present day practices and policies have impacted the "achievement gap" through the lens of opportunities and disinvestment. The lens of opportunities and disinvestment specifically includes (a) historic (i.e., red-lining, school segregation), (b) economic (i.e., funding inequities that heavily impact racially segregated and under-resourced schools), (c) sociopolitical (i.e., nonrelevant education curriculums that exclude the knowledge about historic and current racialized conditions for BIPOC), and (d) moral (i.e., approval or silence in the practices, research, and policies that have harmed communities of color). Examining through the lens of opportunities and disinvestment is critical to addressing the root causes of educational inequity, including the disproportionate burden of risk of grade retention and becoming overage.

Noneducational Opportunities and Disinvestment

Place

The disproportionate rate of Black and Latine students who are overage for grade cannot be understood apart from the segregated and economically marginalized urban contexts in which they tend to reside. Economically disadvantaged young people who reside in high-burden communities have drastically different life chances compared to young people who reside in well-resourced communities; in fact, neighborhood effects research has shown that a young person's zip code predicts a range of socioemotional, behavioral, and academic outcomes, including how well they will do in school (Wolf et al., 2017). And, as economically disadvantaged young people encompass heterogeneous groups, Black and Latine communities are disproportionately impacted by systematic economic disadvantage. In particular, young, economically disadvantaged Black and Latine people reside in neighborhoods characterized by concentrated disadvantage—unemployment and underemployment, poverty, high percentage of

female-headed households and racial segregation (Massey, 1990; Sampson, 2013; Wilson, 1987). This is attributed to historically racialized assignments of urban space, policies, and practices such as redlining and restrictive covenants that resulted in structural disinvestment and inequitable distributions of access and opportunity, such as housing, employment, food access zones, and well-resourced schools (Massey, 1990; Sampson, 2013; Wilson, 1987).

HOLC Maps and Redlining

Although a number of factors have contributed to the sociohistorical conditions that have produced inequitable distributions of access and opportunity for Black and Latine communities, the impact of the Home Owners Loan Corporation (HOLC) redlining continues decades later (Greenwich, 2018; Katznelson, 2005). In response to rising unemployment and home foreclosures following the Great Depression, government officials used HOLC to devise a neighborhood rating system that undervalued neighborhoods the government considered low-income, declining, immigrant, or nonwhite (K. Jackson, 1985). Using this system, BIPOC communities were rated most "risky" and thus least desirable and uninsurable, with Black neighborhoods rated the most "hazardous." Coalescing into residential security maps or "redlining maps" used by the HOLC and later by the Federal Housing Administration (FHA), the government systematized and institutionalized the practice of appraising neighborhoods based on density, racial and ethnic composition, and housing age in 239 cities across the United States (K. Jackson, 1985). Mortgage and bank lenders also institutionalized redlining practices (K. Jackson, 1985), as they became standard blueprints for providing finance opportunities to whites, systematically excluding Black and Latine people from single-housing development, mortgage procurement, and secure housing (Guttentag & Wachter, 1980).

Researchers have shown evidence of the generational effects of redlining with patterns of social, economic, and racial residential segregation and have associated these patterns with a range of life-course outcomes for young people growing up generations later (Aaronson et al., 2021; Greenwich, 2018; Manduca & Sampson 2019; K. A. Park & Quercia, 2020; Roithmayr, 2004; Rothstein, 2017). Greenwich (2018) documented an example of generational effects by examining high school dropouts in Rochester, New York in relation to the 1930s HOLC redlining map. Greenwich found the highest concentration of high school dropouts overlapped almost identically with the areas that government officials redlined nearly a century ago and correspondingly continue to experience the highest rates of poverty. To advance the understanding of areas of greater or lesser opportunity as they relate to the overage student, it is important to examine the geographic distribution and concentration of students who are overage for grade as they relate to historically racialized assignments of urban space (see Appendix A).

Structural Distributions of Opportunity and Disinvestment

Despite the Fair Housing Act of 1968 that outlawed exclusionary zoning policies, there has been extant evidence of continued racial discrimination in housing purchases and rentals, preventing access to secure housing and shifting economic capital away from BIPOC communities (Perry, 2019; Rothstein, 2017). Researchers have linked the implementation of institutional practices such as redlining communities along with the amalgamation of discriminatory and racist policies[4] with the concentration of wealth among white communities

[4] Other means of housing discrimination included confidential city surveys and the appraisers' manual with overtly racist categories developed by the Fair Housing Act, restrictive covenants, and block busting. Block busting was a practice where real estate brokers and owners would convince white people to sell their property at low rates by spreading fear that Black people, in particular, were going to move into the neighborhood. The real estate brokers would in turn lease the properties to Black families at a very high premium. As more and more white people received loans and other means of financial support, they moved away from neighborhoods that were becoming predominantly Black and/or mixed urban communities and left for the suburbs (Katznelson, 2005; Rothstein, 2017).

and the concentration of poverty among BIPOC communities. Researchers also found institutional policies played a key role in the social transformation of ghettoization, systematic segregation, and concentrated disadvantage (Massey & Denton, 1993; Wilson, 1987).

Despite decades of urban social transformations,[5] patterned distributions of opportunity and disinvestment/lack of investment have persisted across various domains at the neighborhood level: socioeconomic (i.e., neighborhood poverty), housing (i.e., percentage of home and rental affordability, home ownership rates), and social and institutional supports (i.e., percentage of household access to food zones and green space)—all of which are established determinants of academic achievement and overall well-being, especially for Black and Brown young people (Brooks-Gunn & Duncan, 1997; Elder et al., 1985; Frndak, 2014; Gorman-Smith et al., 1999; Hughey et al., 2016; Kelleher et al., 2018; Massey, 1990; Rothstein, 2017; Sampson et al., 2008). The large body of research that has focused on structural characteristics of high burden neighborhoods across these domains (e.g., socioeconomic, housing, institutional supports) that might carry risk, such as living in neighborhoods with concentrated poverty, limited access to supports or affordable housing, has established that "neighborhood matters" (Henry et al., 2014) for a young person's academic trajectory. Furthermore, in response to this research that focused on structural characteristics of high burden neighborhoods, and to help address questions of educational equity in the nation's K–12 education system, the Committee on Developing Indicators of Educational Equity was formed to identify a framework with key indicators that

[5] Housing officials have poorly implemented policies meant to improve the plight of economically disadvantaged Black residents and eliminate residential segregation. Officials have also oftentimes undercut policies through discriminatory plans. For example, officials created the development of the urban renewal programs to regenerate declining urban neighborhoods by addressing the challenges of housing shortages and redevelopment of deteriorating buildings. Unfortunately, officials never replaced 90% of the units they removed through urban renewal (Katznelson, 2005). The Department of Housing and Urban Development and racialized housing practices essentially caused deterioration of the available housing present in urban communities.

measure equitable access to resources and opportunities (National Academies of Sciences, Engineering, and Medicine [NASEM], 2019). The committee contended many issues of inequity stem from outside of school settings, such as residential segregation and neighborhood poverty, and therefore, an indicator system that encompasses all the domains of opportunity is necessary to target the root causes of disparities in student outcomes.

Socioeconomic Factors

A range of neighborhood level factors associated with the social and economic health of neighborhoods can be traced back to a systematic lack of investment in particular neighborhoods and communities. The systematic lack of investment and disinvestment has resulted in areas characterized by neighborhood concentrated poverty with high shares of families living in poverty, high unemployment rates, high rates of households on public assistance support, and residential segregation (Massey & Denton, 1993; Wilson, 1987).

A substantial body of research found living in high poverty neighborhoods was associated with an increased risk of poor educational outcomes, such as chronic absenteeism, suspensions, cognitive and verbal ability, and behavioral health challenges—all of which are factors related to not completing high school (Ellen & Turner 1997; Harding, 2003; Rumberger, 2010; Sampson et al., 2008). For instance, Harding (2003) used data from the Panel Study of Income Dynamics to examine dropout rates among young people who lived in high poverty census tracts compared to those in low poverty tracts. Harding found large differences in high school dropout rates that equaled around 12 percentage points for young people who lived in high poverty tracts. Harding found similar differences in dropout rates for both Black and non-Black young people who lived in high poverty tracts, suggesting that living in high poverty neighborhoods played an essential role on a person's academic trajectory across racial and ethnic

groups. On the contrary, Locke and Sparks (2019) used data from the Early Childhood Longitudinal Study to examine structural inequalities on education outcomes and found neighborhood poverty increased the risk of retention for Latine youth, but not for Black youth despite living in similar levels of poverty. These mixed results suggested there is value in examining variation across neighborhood disadvantage and structural characteristics.

Sampson et al. (2008) examined verbal cognitive ability among African American youth living in neighborhoods that varied with respect to an index of neighborhood concentrated disadvantage, which included percentage of: families living in poverty, households receiving public assistance, employment, African American identity, young people under 18 years of age, and female-headed households. They found young people living in the most disadvantaged quarter of Chicago neighborhoods (e.g., high rates across all six indexes) reduced student verbal test scores by one quarter of a standard deviation, which is roughly equivalent to missing 1 or 2 years of school. Furthermore, Coulton et al. (2009) examined 10 disadvantaged neighborhoods and found considerable variation across structural characteristics, including socioeconomic composition, household mobility, homeownership rates, college completion, share of households with employed adults, and percentage of family poverty. There were several neighborhoods with comparable high poverty rates that differed considerably across other neighborhood characteristics. For instance, one high poverty neighborhood had a large share of homeowners (54%) and moderate employment (65%), though little formal education (46%), whereas another high poverty neighborhood had an extremely low share of homeowners (12.5%) with slightly higher employment (69%), and extremely low formal education (12.5%). These findings suggested that examining disadvantaged neighborhoods across various structural characteristics would be meaningful for neighborhood-change efforts to identify areas of intervention for young

people that reside in these neighborhoods. For instance, extant literature has documented the association between parent employment instability or unemployment and negative education outcomes for young people, including grade retention, high school noncompletion, and more discipline infractions in school (Kalil & Ziol-Guest, 2008; Wodtke et al., 2011). If one neighborhood with low rates of grade retention is characterized by high rates of poverty and parent unemployment but has high shares of households receiving public assistance and high rates of affordable housing, then it may lead researchers and policy makers to locate and further examine the potential positive effects of affordable housing on grade retention or education attainment.

Housing

Researchers have long argued that housing can be a positive pathway to achieve better school outcomes. Affordable and high-quality housing can go beyond providing basic shelter. Harkness and Newman (2005) used the 1997 National Survey of America's Families and supplement data on the geographic variation in housing affordability to examine the associations between variations in housing affordability and youth outcomes, such as school engagement and performance, behavioral and emotional problems, and health. They found young people living in areas with affordable housing were associated with better health, school engagement, and being at grade level. Their study findings also suggested young people living in areas with affordable housing were less likely to live in crowded conditions and were less likely to experience food worries (Harkness & Newman, 2005). Furthermore, their findings provided greater support for their hypothesis that the adverse effects of housing unaffordability effected young people through material deprivation and resources rather than through mechanisms of family stress.

In addition to housing affordability, Cunningham and MacDonald (2012) showed housing consisted of four different but interrelated dimensions: affordable housing, housing quality (i.e., over-crowded), residential stability (i.e., homeownership), and a safe and healthy neighborhood location—all of which had direct and combined effects on education outcomes. Affordability, in many ways, influenced residential instability, as families constantly moved to search for more affordable units (Coulton et al., 2009; Crowley, 2003). Coulton et al. (2009) used two waves of survey data to analyze systematic patterns of residential mobility and its contribution to neighborhood change in the 10 Making Connections neighborhoods across the United States. There was some evidence suggesting residents may have benefitted from the relative neighborhood residential stability that surrounded them, whereas high residential mobility increased neighborhood poverty (Coulton et al., 2009). In a longitudinal study using the University of Michigan Panel Study of Income Dynamics data, Haveman et al. (1991) found high rates of residential mobility had negative effects on high school completion, was more prevalent than poverty or being on public assistance, and had lasting effects on the behavioral health of students.

The role of home ownership in residential mobility deserved particular attention, as it has related to housing instability and housing quality (Haurin et al., 2002). Homeowners moved less frequently than those who rented (Yamaguchi, 2003) and home ownership has had positive effects on young people and their neighborhoods (Green, 2001). For example, Harkness and Newman (2003) suggested home ownership served as a factor promotive of high school completion for young people even in distressed neighborhoods. Additionally, home ownership had positive effects on test scores (Haurin et al., 2002) and was associated with higher rates of academic achievement (Galster et al., 2007). Conversely, Mohanty and Raut (2009) used the

University of Michigan Panel Study of Income Dynamics to examine whether home ownership had positive effects on academic achievement. Although they found no independent effects of home ownership, they found positive significant effects of home environment, neighborhood quality, and residential stability on the reading and math performance of youth between the ages of 3 and 12. The findings suggested these collective neighborhood characteristics may have had a more powerful impact on education outcomes than home ownership on its own. Continuing to examine disadvantaged neighborhoods across various structural characteristics is necessary, particularly in the context of education. Given the importance of housing on student achievement, and the sparse literature on the impact of neighborhood level housing characteristics on grade retention, it is an imperative first step to (a) examine whether overage students are concentrated in neighborhoods characterized by high or low percentages of housing affordability and home ownership, and (b) examine how they are associated with overage students to learn how and where to intervene at the systemic level.

Social and Institutional Supports

Elements of the built environment, such as parks and recreational spaces, have been associated with positive socioemotional and behavioral health known to foster positive academic performance (Hughey et al., 2016; R. J. Jackson et al., 2013). Recent researchers have documented the direct association between green space and academic outcomes (D. Li et al., 2019). D. Li et al. (2019), for instance, examined the association between green space and tree cover density and high school freshmen who are academically on track to graduate. They found tree cover density within 1 mile of the school location showed a strong association with freshmen on track, even after controlling for factors known to influence academic performance. A growing body of research has addressed the distribution of public parks, recreational, or green

space by neighborhood socioeconomic status and found mixed results. Some researchers documented poor neighborhoods had less available parks and recreational spaces (Harris et al., 2015; W. C. Taylor et al., 2007; Wolch et al., 2005), whereas other researchers found a higher availability of parks and recreational spaces in poor neighborhoods compared to higher income neighborhoods (Sister et al., 2010; Vaughan et al., 2013). This study contributes to the growing body of research on green space by examining its association with the probability of being overage for grade at the census tract level.

Furthermore, one study showed high-burden neighborhoods were more likely to be impacted by low food access zones (i.e., lack of nearby supermarkets in a person's neighborhood or community; Kolak et al., 2018). Low food access zones have been associated with economic inequities that led to a number of supplementary challenges related to health, behavioral health and academic outcomes, and have been found to overlap with education deserts (Brown & Brewster, 2015; Frndak, 2014; Williams & Dixon, 2013). Kolak et al. (2018) found that although Black people made up one third of the Chicago population, 80% lived in low or volatile food access areas. Gallagher (2006) found residents of predominantly Black neighborhoods in Chicago had to travel 40% farther on average for the nearest supermarket compared to residents of majority white neighborhoods. In a more recent study, Kolak et al. (2018) found that although the total number of grocery stores increased across Chicago over the years, economically and racially segregated neighborhoods with low food access did not see improvements. Community assets and strategies of resistance, such as community gardens and urban farming, have been used to respond to student disengagement among young people who lived in high-burden neighborhoods with low food access (Campbell, 2017; Reynolds & Cohen, 2016; White, 2017). For example, Fifolt et al. (2018) fostered school connectedness, engagement, and improved

social-emotional outcomes for young people who lived in economically disadvantaged areas in Birmingham, Alabama through school-based urban farms. The aforementioned research on the effects of structural disinvestment, opportunities, assets, and quality inputs in economically disadvantaged neighborhoods has shown the unintended consequences on an array of outcomes, including academic achievement and attainment. The current study contributes to the growing body of research on opportunity structures in the built environment (Astor et al., 2021; Gray et al., 2018; The Transdisciplinary Resistance Collective for Research and Policy et al., 2020) and illuminates the extent to which particular assets or lack of investments are associated with students who are overage for grade.

Educational Opportunities and Disinvestment

Institutions and Schools

Researchers have shown that racist housing policies and the concentration of subsidized and substandard housing in racially and economically segregated neighborhoods shaped a substantial share of school segregation (P. L. Carter & Welner, 2013; Fine et al., 2010; Greenwich, 2018). As local property taxes largely have funded schools, the distribution of educational funds have favored those living in wealth, leaving high-poverty neighborhoods to be part of low-resourced school districts with limited opportunities (P. L. Carter & Welner, 2013). Even within-districts, where schools were receiving the same per-pupil funding in theory, there were other sources of disparity such as school-based fundraising in whiter and wealthier schools (Karp, 2015; Kunichoff, 2021). An analysis by Chalkbeat found that of the 513 district-run Chicago Public Schools, at least 100 schools had a school-based fundraising network, with the majority concentrated on the city's whiter and wealthier North Side, contributing to disparities among schools (Kunichoff, 2021).

Inequitable patterns of school funding between and within districts meant young people in lower-funded districts or schools did not have access to the same resources their peers in districts with higher levels of funding had (P. L. Carter & Welner, 2013). Patterns of school opportunity vary even across short distances due to boundaries of school districts—what many scholars have called the redlining of education (Greenwich, 2018; Schott Foundation for Public Education, 2013; Spatig-Amerikaner, 2012). The majority of students who struggled the most in school were concentrated in a small fraction of the nation's schools that were impacted by inequitable patterns of school opportunity. For instance, Orfield (2013) found students who did not complete high school were concentrated in about 2,000 of the 24,000 secondary schools in the United States. In many cases, young people impacted by economically disadvantaged neighborhoods and low-resourced school districts did not receive the requisite supports they needed to succeed (P. L. Carter & Welner, 2013).

The Committee on Developing Indicators of Educational Equity was formed in 2019 to address educational equity and to identify key indicators of equitable access to resources and opportunities in the K–12 education system (NASEM, 2019). The identified indicators included the structural aspects of school systems that may have impacted opportunity, amplified existing disparities in neighborhood contexts, and contributed to unequal outcomes for students. Some of these indicators included concentration of poverty in schools, racial and ethnic diversity of the teaching force, disparities in suspension and expulsion rates, perceptions of safety and student–teacher trust, and disparities in curricular breadth such as civic engagement (NASEM, 2019). The committee contended it would be advantageous to examine equity indicators, collectively, which would allow comparisons of schools, districts, and states, and provide a more nuanced picture that can aid in policy level change.

Educational Lack of Investment and Disinvestment

Astor et al. (2021) illustrated certain schools' internal contexts, such as school poverty (Y. Li et al., 2017) and punitive measures (e.g., suspension, expulsion; Annamma, 2017) exacerbated the negative effects of external ecological influences on student academic achievement, increased student absences, and led to high school noncompletion (C. M. Park, 2019; Patterson et al., 2007; Rumberger & Lim, 2008). For instance, high poverty urban schools generally had higher rates of educational challenges, such as student absenteeism, suspensions, lower average test scores, higher pushout rates, and were disproportionately targeted for school closures relative to suburban wealthy schools and schools in nearby middle-class communities (Darling-Hammond, 2007; Ewing, 2018; Gottfredson et al., 2005; R. J. Skiba et al., 2004). Many high poverty schools were associated with large numbers of students in poverty, however, many high poverty schools lacked the financial resources needed to provide necessary supports and services to the students they served, such as access to school counselors and social workers, or additional academic supports. In many high-poverty schools, retention rates reached 50% (Alexander et al., 2003). Therefore, it is imperative to examine school level poverty rates among elementary schools and their impact on the odds of being overage.

Schools with high poverty rates have also been part of a larger racialized system that generates a high rate of disciplinary referrals and commonly relies on school policing and punitive measures (i.e., suspension that further harm Black and Latine students; Annamma, 2017; Barnes & Motz, 2018; P. Carter et al., 2017; Nance, 2015; Shedd, 2015). Shores et al. (2020) found grade retention and disciplinary action were commonly clustered together in districts with high poverty rates, which further intensifies education inequity. R. Skiba et al. (2014) found suspension rates were associated with poor student achievement, and Chu and

Ready (2018) and Rumberger and Losen (2016) found suspension rates were associated with high school noncompletion.

The Committee on Developing Indicators of Educational Equity suggested addressing suspensions was particularly important to equity concerns given the disproportionate rates in suspension among Black and Latine students (NASEM, 2019). For example, researchers have shown high suspension rates to be predictive of punitive measures across schools, particularly toward Black and Latine students who attended both diverse schools and schools serving mainly BIPOC students; an abundant amount of studies have found Black and Latine students did not generally misbehave more than white students, yet were suspended at much higher rates than white students (Arcia, 2007; Schiraldi & Ziedenberg, 2001). Extant literature also suggested schools with high discipline rates generally had higher rates of educational challenges, including high grade retention rates, poor test scores and grades, and high school noncompletion (C. Kim et al., 2012; Shedd, 2015). By design, punitive policies excluded students from the classroom and limited their opportunities to obtain necessary classroom instruction, which raised particular concern for students who were overage or at risk of grade retention. Punitive discipline policies may also have impeded students' perceptions of safe, fair, and equitable treatment in their schools and contributed to declines in school engagement (Leath et al., 2019; Sartain et al., 2015). For instance, extant studies found harsh school discipline created conditions whereby students learned their needs were irrelevant, which led to a sense of disempowerment, sent the message students were potential criminals, and prepared students for disengagement from school (Fine, 1991; Fine et al., 2004; Kupchik, 2010). Hinze-Pifer and Sartain (2018) examined reductions of suspension rates among schools with predominantly Black students and found they were associated with improvements in attendance, engagement in school, test scores, and

positive perceptions of school climate. Given extant research, this study examined school discipline among CPS elementary schools and their association with the probability of being overage.

Educational Opportunities

Schools have represented a system that logically could resist imposed structures of power and become advocates for struggling students through opportunities for appropriate resources. The Committee on Developing Indicators of Educational Equity (NASEM, 2019) and Astor et al. (2021) both illustrated through their frameworks that school internal contexts, such as increased number of BIPOC teachers, increased student–teacher trust, positive racial school climate, and civic engagement could serve as opportunity structures for students to help overcome the effects of systematic lack of investment (or what they call deficient external opportunity structures), and improve positive academic outcomes (Griffin et al., 2020; Jankov & Caref, 2017; Martinez, 2018).

Adults in school matter to the academic success of students and can serve as assets in school structures. C. M. Smith and Herzog (2014), for instance, found students who failed or were retained noted they would have embraced additional assistance from teachers and other adult supports in the school. The Committee on Developing Indicators of Educational Equity (NASEM, 2019) contended BIPOC teachers, in particular, and their match to the student body merits inclusion in a system of equity indicators (Gershenson et al., 2016). Gershenson et al. (2018), for instance, found teacher–student racial match negatively correlated with high school dropout, and Holt and Gershenson (2019) found it was negatively associated with student disciplinary outcomes. Similarly, Egalite and Kisida (2017) found teacher–student racial match was associated with improved test scores and positive attitudes toward school. In the Tennessee

Student/Teacher Achievement Ratio (STAR) study, the positive effects of being randomly assigned to an own-race teacher on a nationally normed achievement test ranged from 5 to 8 percentile points for both Black and white students (Dee, 2004). Furthermore, Black students who were randomly assigned to a Black teacher were 7% more likely to graduate high school and 13% more likely to aspire to college than Black students who were not randomly assigned to a Black teacher (Gershenson et al., 2018).

Moreover, student–teacher relationships in which the student and teacher shared a high level of mutual trust and respect (Steinberg et al., 2011) and the teachers identified as BIPOC (Yarnell & Bohrnstedt, 2018) contributed to Black and Latine students' perception of school safety, student engagement, and student success. For instance, BIPOC teachers have been associated with enhanced feelings of belongingness to the school and higher levels of achievement among Black and Latine students (Clewell et al., 2001; Clotfelter et al., 2005; Dee, 2004; Egalite et al., 2015). Yarnell and Bohrnstedt (2018) found negative associations of Black student achievement were strongest in classrooms taught by white teachers. The more trusting relationships students had with adults in the school, the more students felt safe and had positive perceptions of their school. For instance, one school located in an underresourced community in Los Angeles implemented student-centered practices that built trust across their school, resulting in no school fights in over 7 years (Astor et al., 2021). This example illustrated how schools could further serve as sites of opportunity by creating safe, trusting and equitable environments.

When schools acknowledged and resisted inequitable, punitive, and imposed structures of power—especially for their most vulnerable students—they created the necessary school environment to enhance student engagement and academic achievement. Scholars have argued for positive racial equity climate and civic engagement to be part of reimagining schools and

classrooms as sites that disrupt mechanisms of inequity and serve to protect students against predictors associated with high school noncompletion (e.g., retention, suspensions, absenteeism; Baker-Bell et al., 2017; Dee & Penner, 2016; Johnson et al., 2017; Putnam, 2015; Voight et al., 2020). For instance, students who perceived their school environment to be racially equitable and fair reported higher levels of behavioral, emotional, and cognitive engagement in school (Griffin et al., 2020), fewer disciplinary problems (Lee et al., 2011), positive social-emotional health (Freeman et al., 2009), increased motivation and school engagement (Griffin et al., 2017), and higher graduation rates (Wang & Degol, 2016). As students who were more likely to experience punitive discipline are Black and Latine students (Gagnon et al., 2017), and overage students were likely to be Black and Latine, racial equitable school climates served as opportunity structures that created spaces for students to feel valued, safe, and subsequently improve academic outcomes (Henderson et al., 2019).

Schools can further serve as sites of resistance for their students. Many education scholars have affirmed educational curricula have been detached from students' lives, experiences, and history as well as lacking in a civic engagement component that would foster student success (Martinez, 2018; Paris & Alim, 2017). Across the country, students who were overage for their grade were disproportionately Black and Latine and lived in concentrated poverty (Rumberger, 2011). Because their life experiences were shaped by sociopolitical factors, scholars have argued for schools to engage students in the process of developing a critical awareness of their social reality through reflection and action (Freire, 1973; Paris & Alim, 2017; Sondel et al., 2018). Freire (1973) argued for young people to think about their self and identity in relation to their social and political circumstance, which encouraged young people to develop the capacity to reflect on their circumstances, promote positive development, and learn to resist

injustices. Without the critical knowledge and appropriate support, young people may have experienced socioemotional and academic challenges as they worked to make sense of and manage their experiences in relation to structural racism and systematic lack of investment and disinvestment (Horner, 2017). Martinez (2018) examined factors associated with the success of overage middle school students and found teachers agreed that existing middle school curriculum was not meeting the needs of overage students and suggested students needed curriculum that fostered student voice, discussed real life experiences, and engaged students as active members of the school community through student-cooperative projects.

Furthermore, Kahne and Middaugh (2008) found white and affluent students were more likely to receive and participate in civic engagement in school, such as learning how laws and policies were made, compared to low-income students who identified as BIPOC (Kahne & Middaugh, 2008). Inequalities in civic education could maintain civic and political marginalization, such as not having their voice represented in government and policy level processes that could potentially resist systemic injustices (Bedolla, 2012; de la Garza & Jang, 2011). Because school curricula that included ways to cultivate students' civic and political knowledge have been found to be imperative to the educational success of Black and Brown young people (Paris & Alim, 2017; Sondel et al., 2018), especially for those that experienced systemic challenges such as residential mobility (Voight et al., 2020), it is equally crucial to examine how civic engagement that addresses social-political issues and movements serve to protect students who are overage for grade. The structural inequities Black and Brown young people experience are inherently political. Thus, the facilitation of knowledge, meaning making, and power in young people to challenge and disrupt systemic inequity is necessary (Dee & Penner, 2016).

Intersection of Neighborhood, School Assets, and Structural Disinvestments

The phenomenon of students who are overage for grade is an entangled power dynamic in and outside the school and neighborhood environment. The confluence of being impacted by opportunity structures across multilevel systems, such as access to supermarkets, stable housing, and quality educational resources and support services can affect levels of engagement and connectedness to school. Many previous studies have addressed neighborhood effects and school context effects on education attainment and other related student outcomes. Accordingly, scholars with robust neighborhood-level data tend to study neighborhood effects, whereas scholars with robust school-level data tend to examine school context effects. However, given the strong correlation between neighborhood and school assets and structural disinvestment/lack of investment on student outcomes (Kirk, 2009), any analysis that overlooks one social context (e.g., neighborhoods) may overemphasize or misstate the effect of the other (e.g., schools), presenting a serious limitation in this body of work.

The Committee on Developing Indicators of Educational Equity (NASEM, 2019) recommended that although they mainly focused on school factors, they encourage future work to incorporate neighborhood level inequity indicators in their current indicator framework to encompass all the domains of opportunity to effectively target the root causes of disparities in student outcomes. Moreover, several scholars (Y. S. Kim, 2016; Kirk, 2009; Owens 2010; Rendon, 2014; Sykes & Musterd, 2011; Yuan & An, 2017) have suggested the importance of incorporating neighborhood and school contexts at the same time to examine the relative effect of these interdependent social contexts. Despite the importance of these relationships, there has been limited research on the interchange between school and neighborhood opportunities and disinvestment/lack of investment on student outcomes. For instance, a review of school and

neighborhood effects studies revealed that only 46 of 238 studies accounted for both neighborhoods and schools in their analyses (Brazil, 2016). Owens (2010) found low odds of education attainment associated with students coming from a neighborhood of concentrated disadvantage were amplified in schools with more white and higher socioeconomic peers. Kirk (2009) examined the interdependent relation among neighborhood collective efficacy and school collective efficacy on school suspensions. Kirk found students that attended schools with low levels of school collective efficacy and lived in neighborhoods with low levels of collective efficacy were more likely to be suspended than students in schools with high levels of collective efficacy and lived in neighborhoods with low levels of collective efficacy. Locke and Sparks (2019) found high poverty schools in areas that were residentially segregated, surprisingly, had lower risk of retention. The authors posited that neighborhoods with high levels of residential segregation may have had teachers that knew how to respond and tailor their lesson plans to their specific student populations. These findings suggested examining simultaneous effects of schools and neighborhoods was important to better understand student outcomes.

It is essential to understand the intricate pathways of education and noneducational opportunity structures that are associated with the experience of students who are overage for grade. Recent studies have contributed to the qualitative experiences shaped by systemic disinvestment of nongraduate students—including those who were considered overage—which included: homelessness or foster care, living in unsafe neighborhoods, witnessing violence, having a family member incarcerated, taking on financial responsibility due to poverty, becoming caregivers for parents and siblings, loss, unstable environment, and increased mobility (Goodman, 2018; Hynes, 2014; Metzger et al., 2015; C. M. Park, 2019). Some nongraduates described their reality of facing adult responsibilities and challenges unrelated to school held

more importance over school attendance (Hynes, 2014). Neighborhood structural disinvestment/lack of investment (e.g., living in a neighborhood with high rates of housing instability), may have influenced the experience of students who were overage, and school opportunities either acted as buffers or simultaneously perpetuated negative outcomes for young students. Following previous researchers' recommendations, it is important to examine the variation of risk at the neighborhood and school level to learn how and where to intervene at the systemic level and disrupt patterns of inequity.

Present Study

Understanding factors related to risk for students who become overage for grade can be misunderstood if only focusing on individual student characteristics without considering contextual factors such as the long-standing structural disinvestment/lack of investment and opportunities in many urban communities. The lived experiences of students who are disproportionally impacted are shaped by the structural conditions of schools and neighborhoods, including structural racism, resulting in circumstances such as living in racially segregated neighborhoods. These racially segregated neighborhoods are often characterized by a long history of disinvestment resulting in inequitable conditions such as food deserts or unaffordable housing (Metzger et al., 2015). This is of concern for large urban school districts and poor rural districts across the country, including the Chicago Public Schools.

The Chicago neighborhoods with the highest concentration of students that enter high school as overage ninth graders have tended to be on the west and south sides of Chicago (Chicago Public Schools, 2014), which are historically racialized assignments of urban space (i.e., redlining). These students have experienced the enduring effects of structural racism well before they scored low on exams, failed courses, or were retained in grade. Inequity among

school districts may reinforce these macro conditions as it creates concentration of high poverty schools that have been found to be associated with punitive discipline and poor school climate. Most efforts to respond to the overage student occurrence have focused on the individual level (Jimerson et al., 2006), with relatively little attention to addressing the system perpetuating inequities.

This study built on a growing body of social justice-oriented research concerned with the systemic influences of opportunity structures and disinvestment/lack of investment, conceptualized as the patterns, options, supports, and access to resources that shape the opportunities for young people (Astor et al., 2021; P. L. Carter & Welner, 2013). Specifically, this study examined how educational (e.g., institutions/schools) and noneducational (e.g., place/neighborhoods) opportunity structures and disinvestment/lack of investment were related to students who were overage for grade. Additionally, this study was designed to examine how and which schools simultaneously resisted those same structures and became advocates for overage students. To seriously disrupt mechanisms of education inequity, young people who have historically and systematically had the least access to resources have to be the focus of educational scholarship and equity undertakings. Structural conditions of schools and communities must also be at the center of educational equity scholarship. This study addressed the following research questions to advance researchers, educators, and policy makers understanding of educational and noneducational structures of opportunity and lack of investments/disinvestment as they relate to students who are overage for grade.

The overall aim of this project was to examine where students who were overage of grade were concentrated, the extent to which risk of grade retention was defined by which neighborhood students lived in, and how much of that risk was mediated by the schools they

attended. Knowing the distribution of overage students in neighborhoods and schools can help educators identify where they need to make changes. If scholars learn the majority of overage students are in specific schools and neighborhoods, education administrators and policy makers can focus on neighborhood and school-wide supports. Separating school and neighborhood influences can help identify schools in need of resources to better serve communities. It also suggests the extent to which school practices currently make a difference. Knowing the characteristics of neighborhoods and schools with higher retention rates could point to potential mechanisms for preventing retention.

Aim 1: Learn who is most at risk of being retained in grade and how that risk is related to neighborhood disinvestment and assets.

1a. In which census tracts are CPS overage students entering ninth grade most concentrated?

1b. Which neighborhood characteristics of assets and disinvestment are most related to the probability of being overage for grade? Such assets and disinvestment may be socioeconomic (i.e., neighborhood poverty), housing (i.e., home and rental affordability, home ownership rates), or social and institutional supports (i.e., percentage of access to supermarket and green space).

These findings help identify how risk of being overage for grade may be different by neighborhood factor. For instance, to what extent is risk most related to poverty, housing, or social supports? Policy implications aim to understand how to get the appropriate economic resources in the right places.

1c. Do characteristics of identity such as race or sex relate to the probability of being overage for grade within and between neighborhoods? For instance, do neighborhoods

with high proportions of Latine students have higher odds of students being overage for grade compared to neighborhoods with high proportions of white students (between effects)? When controlling for racial composition within the neighborhood, does Latine student have higher odds of being overage for grade (within effects)?

Aim 2: How is risk of being retained related to elementary school characteristics?

2a. Which school characteristics (i.e., school poverty rate, student suspension rate, student–teacher trust, school safety) are linked to the probability of students being overage for grade?

2b. Do characteristics of identity such as race or sex relate to the probability of being overage for grade within and between elementary schools?

2c. How much variation of risk is explained by elementary school level and how much is explained by neighborhood level?

Aim 3: Which school characteristics relate to high school completion for students who begin high school as overage for grade?

3a. Do civic engagement and racial equity climate in schools promote high school completion for overage students?

3b. Do they reduce the difference in graduation rates for retained students compared to students at grade level differentially based on race and sex?

Chapter 3: Research Design and Analytic Strategy

Research Design and Methods

Study Design

This study used a critical quantitative perspective (Garcia et al., 2018) using multilevel mixed-effects binary logistic regression models to gain a richer understanding of educational and noneducational effects on overage students. This study drew from the Transformative Racial Equity Framework (The Transdisciplinary Resistance Collective for Research and Policy et al., 2020) and incorporated a social epidemiology (Krieger, 2001) and critical quantitative approach (Garcia et al., 2018; Gillborn et al., 2017; Strunk & Betties, 2019), addressing the issue of students who were overage for grade (hereafter referred to as students overage) at the population level, rather than focusing solely on the individual. Moreover, this study employed a historical perspective to examine how the distribution of students overage was associated with present-day unequal inputs of opportunity and disinvestment. This framework also allowed for the illumination of the assets at the school level to support the promotion of high school graduation for students overage. The present study aimed to use this perspective to indicate the population prevalence at every level (i.e., neighborhood, schools, and the predictors of these things) to determine who was at risk, under what conditions, and what structural disinvestment/lack of investment and opportunities shaped population at the structural level.

Data Acquisition

To address the research questions, I used existing Chicago Public School (CPS) longitudinal data in partnership with the University of Chicago Consortium on School Research, which incorporated data at the neighborhood (e.g., student zip code), school (e.g., poverty rate, school climate), and student level (e.g., grade, race, home address, birthdate). I worked in

collaboration with CPS beginning in July of 2020, including presenting research ideas to CPS leadership, finalizing a CPS partner to receive project approval, and meeting with CPS partners and leadership to collaborate on research questions and areas of interest. After receiving verbal approval, I submitted a Statement of Work for written approval, and then received access to the data in April 2022. To answer the research questions related to noneducational factors (i.e., neighborhood), I used the Child Opportunity Index 2.0 (COI) and merged it with existing CPS data.

Neighborhood Data

Census tract was used as the geographic unit representing a Chicago "neighborhood." This decision was informed by (a) previous research of neighborhood effects conducted in Chicago (Henry et al., 2014; Sampson et al., 1997), (b) the fact that census tracts generally correspond well with what is commonly meant by the term "neighborhood," both with regard to population and geographic size (Henry et al., 2014), and (c) Chicago school catchment areas generally align with census tracts. Although some analyses of Chicago used the familiar 77 established community areas as the geographic unit developed by sociologists at the University of Chicago in the late 1920s (Dzik, 2009), community areas were much bigger and could hide some of the important variations in local contexts. For example, one Chicago community area, Little Village, had two high schools and two alternative high schools that were situated on opposite ends of the same community area (i.e., east side and west side). The west side had higher rates of employment, lower rates of residential mobility, more owner-occupied housing, and a higher percentage of second-generation immigrant families. A focus at the census-tract level illuminated important differences in the community. All student home addresses were

geocoded and tied to census tracts. This allowed the opportunity to get census data on the characteristics of each tract to answer the research questions related to noneducational factors.

The most precise neighborhood data available, which referenced the characteristics highlighted in this study, were the census tract level data obtained via the COI. The COI includes 29 indicators that measure neighborhood-based opportunities for children including but not limited to high-quality schools, access to supermarkets and green space, and socioeconomic resources. The 29 indicators are grouped into three domains: education, health and environment, social and economic. The COI is available for virtually all neighborhoods (i.e., census tracts) in the 50 U.S. states and Washington, D.C. for two time points, 2010 and 2015. It is accessible as a downloadable database that provides a single, harmonized database of the composite index measures and individual indicator.

Data Analytic Sample

Four CPS student cohorts were included in this study: Cohort Fall 2012 (eighth graders who entered ninth grade in Fall of 2012); Cohort Fall 2013 (eighth graders who entered ninth grade in Fall of 2013); Cohort Fall 2014 (eighth graders who entered ninth grade in Fall of 2014); and Cohort Fall 2015 (eighth graders who entered ninth grade in Fall of 2015). Students who attended any CPS elementary schools (i.e., Grades K–8) and high schools, except alternative or charter schools, were included in the study given that charter and alternative schools permitted forms of policy flexibility that were not captured in this particular study. First time ninth graders for each of the four cohorts were included in the study, excluding any ninth grade repeats from prior years. Students overage for grade were created and defined by CPS's definition, such that elementary students who were 15 years old or were going to be 15 years old

by September 1st the year entering high school were considered overage for grade; the expected age for beginning ninth graders was 14 years old.

Measures

Dependent Variables

Overage Student

CPS administrative master files were used to determine CPS students who were overage for grade by the time they entered ninth grade for the first time and attended a CPS high school. Their birthdates and whether they were first-time ninth graders were used to determine their overage or at-age status. CPS elementary school students who were 15 years old or would be 15 years old by September 1st the year entering high school were considered overage for grade.

Four-Year High School Graduation

CPS students were classified as graduates if they started ninth grade in a CPS high school and graduated with a CPS high school diploma in 4 years. Students were classified as not attaining their high school diploma if their administrative records showed they left school without a diploma, transferred to a different district, or were still enrolled in school but had not yet received a high school diploma in 4 years. Students who transferred out of CPS were counted as nongraduates, which meant graduation rates in the present study were biased downward. Although graduation rates were lower than the actual rates, they had the advantage of ensuring that students who were mis-coded as transfers did not actually leave school. Furthermore, students who received an alternative school diploma were not counted as graduates. Although alternative school diplomas met state requirements, they did not meet district requirements, which were higher and required college preparatory curriculum.

Independent Variables

Individual-Level Factors (Level 1)

Demographics. Race and sex were linked by student identification (ID) number using CPS administrative data. Sex was described in binary terms (i.e., male, female). Four race groups were created using CPS categories of student race: non-Hispanic white (white), Black/African American (Black), Latino/Latina (Latine), and Asian/Pacific Islander (Asian). Students marked as Asian, Asian/Pacific Islander, or Pacific Islander/Hawaiian were recoded as Asian.

Suspensions. Suspensions were linked by student ID number using CPS discipline data. Student suspensions were calculated based on the number of total incidents (both in-school and out-of-school suspensions) a student received over the course of their eighth grade year. Students who had no suspensions were coded as 0 and not missing.

Absences. Absences were linked by student ID number using CPS absent data. Student absences were calculated based on the number of total absences a student had over the course of their eighth grade year.

Test Scores. The state test assessment, the NWEA, was used to calculate students' eighth grade test scores. Both reading and math percentile scores were linked by student ID number using CPS test score data.

Failed Courses. Grades were linked by student ID number using CPS grade files for their total eighth grade year. Total number of failed classes for each student were calculated. Students with no failed classes were coded as 0.

Neighborhood-Level Factors (Level 2)

The following variables were pulled from the COI (year of observation 2015, with average data from 2010–2014) by census tract.

Home Ownership. The percentage of homeowners in each census tract. This is calculated by the number of housing units that were owner occupied divided by the number of housing units, times 100. Each census tract was linked to the census tract that a CPS student resides using CPS administrative data.

Home and Rental Affordability. The percentage of homeowners and renters who paid more than 30% of their household income for housing costs in each census tract. Each census tract was linked to the census tract that a CPS student resides using CPS administrative data.

(Limited) Access to Supermarket. The percentage of households without a car located further than a half-mile from the nearest supermarket. Each census tract was linked to the census tract that a CPS student resides using CPS administrative data.

Green Space. The percentage of green space in each census tract. Each census tract was linked to the census tract that a CPS student resides using CPS administrative data. Impervious surfaces were covered by impenetrable, artificial materials, such as brick, concrete and asphalt and included structures such as roads, pavement, parking lots, buildings, and roof tops. Access to green space was then defined as the inverse of the percentage of census tract covered by impervious surfaces. They standardized the indicator and then multiplied the resulting *z* scores by -1.

Neighborhood Poverty. This variable can be found in the 2010 American Community Survey (already geocoded to student addresses through the University of Chicago Consortium on School Research). The poverty level in each census tract, estimated as standard deviations above and below the mean (higher is worse). This variable was calculated by taking the percentage of adult men not employed and the percentage of families with incomes below the poverty line for

each block group and then standardizing that across the city. Block groups were then coded to be matched to appropriate census tracts.

School-Level Factors (Level 2)

The following school level factors were pulled from the CPS master dataset through the University of Chicago Consortium on School Research.

Student Suspension Rate (Percentage). Calculated by taking the number of total students suspended in each school year and dividing by total number of students in each school, times 100.

BIPOC School Staff (Percentage). Calculated by taking the number of staff in each school that identify as BIPOC and dividing it by total staff of school, times 100.

School Poverty. School poverty was a variable that exists in the University of Chicago Consortium on School Research. It was the level of poverty in each school, estimated as standard deviations above and below the mean (higher is worse). It was calculated using multiple variables tied to students' residences, including unemployment, median income, and percentage of families under the poverty line in students' census group that made up school composition.

The following school level variables were obtained from the 5Essentials survey. The 5Essentials survey is a diagnostic survey used across Chicago Public Schools that provides insights into schools' organizational strengths and areas of opportunity across five essential factors, including (a) effective leaders, (b) collaborative teachers, (c) involved families, (d) supportive environment, and (e) ambitious instruction. The survey also provided insight on schools' culture and climate to improve overall student outcomes. Each of the variables had a score that described a school's performance on the 5Essentials as a group; school is strong/very strong (eScore >= 60), neutral (eScore between 39 and 61), or weak/very weak (eScore < 40) on

that essential. All of the measures were reliable at a level of 0.6 or higher based on the Rasch model reliability statistic (Hart et al., 2020; Luppescu & Ehrlich, 2012).

Students' Perception of Student–Teacher Trust. Student–teacher trust focused on the quality of relationships between students and teachers. Students were asked whether they believed teachers could be trusted, cared about them, kept their promises, listened to students' ideas, and if they felt safe and comfortable with their teachers. Responses ranged from 1 (*strongly disagree*) to 4 (*strongly agree*). Higher scores indicated students perceived positive student–teacher trust at their school. See Appendix B for specific scale items.

Students' Perception of School Safety. School safety measured a reflection of students' sense of personal safety inside the school, outside the school, and traveling to and from school. Responses ranged from 1 (*not safe*) to 4 (*very safe*) with high scores indicating student perceptions of positive school safety. See Appendix B for specific scale items.

Students' Perception of Racial Equity School Climate. Racial equity school climate measured the extent to which each student perceived their school as fair and equitable. Responses ranged from 1 (*strongly disagree*) to 4 (*strongly agree*). Statements included, "race is a factor in decisions about discipline at this school," "race influences adult's expectations for students at this school," "race influences whether students have access to advanced courses," and "race influences the overall quality of education that students receive in CPS." Lower scores indicated positive racial equity school climate. See Appendix B for specific scale items.

Students' Perception of School Civic Engagement. School civic engagement measured the extent to which each student experienced civic engagement in their course. Statements included, "this year in my class, I have: discussed current events and/or controversial issues, learned about societal issues I care about, worked on an action project to respond to an issue that

impacts my community or society, involved in a project that improves my school or community," etc. Responses ranged from 1 (*strongly disagree*) to 4 (*strongly agree*), but some responses ranged from 1 (*never*) to 5 (*almost every day*) when asked about civic engagement activities in the classroom. Higher scores indicated positive school civic engagement. See Appendix B for specific scale items.

Data Analytic Strategy

Data Preparation

Data preparation tasks were conducted using SAS Analytics software and Stata 17.0. CPS student cohorts unique to this study were created based on inclusion criteria (i.e., first time freshman, attended a CPS elementary school, and entering a CPS high school), and exclusion criteria (i.e., attended a non-CPS Elementary or non-CPS High School). Ninth grade status was checked for 3 years prior to ensure students were first time ninth graders. There were 1,495 (6.5%) ninth grade repeats for ninth grade Cohort 2012, 1,542 (6.9%) ninth grade repeats for ninth grade Cohort 2013, 1,413 (6.3%) ninth grade repeats for ninth grade Cohort 2014, and 966 (4.6%) ninth grade repeats for ninth grade Cohort 2015. Overage students were created and defined by CPS's definition, such that elementary students who were 15 years old or were going to be 15 years old by September 1st of the year entering high school were considered overage for grade.

Student, elementary, and high school level variables were obtained from CPS Data through the University of Chicago Consortium on School Research and matched in the dataset by student ID number and school ID number. Sex was described in binary terms (i.e., male, female); four race groups were created using CPS categories of student race: non-Hispanic white (white), Black/African American (Black), Latino/Latina (Latine), and Asian/Pacific Islander (Asian).

Unfortunately, Native students could not be included in this study given that only 0.3% of the sample were overage and made up only 0.4% of the total CPS sample in this study. In cases like this where quantitative measures did not have the statistical power to capture the experiences of Native students, qualitative studies are incredibly important to learn about and further understand their educational and noneducational experiences. The status (i.e., still active in CPS) and reason for leaving variables for each student were checked each fall and spring semester until their fall semester of their 5th year to ensure an accurate account of their status and outcome. Final codes included graduated, transferred, dropped out, or still active after 4 years in a CPS high school. Graduation was coded as a binary variable (1 = graduated from CPS in 4 years, 0 = not graduated from CPS in 4 years).

Elementary school variables and individual level variables were obtained for students' eighth grade year, and high school variables were obtained for their 12th grade year. Student level variables that had a significant value in determining whether a student got held back or not were included, such as NWEA reading and math scores, absences, failed courses, and suspensions. Although each of these factors held significant value for grade retention, there was no direct pathway to being retained. By including these variables, the researcher determined the degree to which being overage for grade was related to those indicators of academic achievement, which were part of the retention policy, and the degree to which retention was not explained by achievement variables. Structural inequity could influence being overage for grade by influencing attendance and achievement (e.g., through ability to get to school on time every day or have a quiet place to study), and also through factors above and beyond academic achievement (e.g., through extra supports that some families or schools might have been able to

access, or perceptions/biases of school staff or families about who should have received an Individualized Educational Plan (IEP) or who would have benefited from staying back a grade).

Elementary school variables were standardized and averaged at the school level to create school average scores. Cronbach's alpha provided estimates of the reliability for the averaged items of the high school level variables, Racial Equity School Climate and School Civic Engagement ($\alpha = .96$, $\alpha = .93$, respectively). The items for each variable were then averaged together to obtain a measure score, and then the student measure scores at the school level were averaged to obtain a school average. The variables were then restandardized at the school level.

A dataset with neighborhood level variables unique to this study was created from the online database, the COI. Neighborhood variables, including affordable housing, home ownership, green space, and access to supermarkets were obtained from the COI and matched by county-level FIPS codes for Illinois, which uniquely identified geographic areas. Census tracts were then identified for Cook County. The neighborhood variables were part of the 2015 file, which was an average of the years 2010–2014. The COI dataset was then merged into the study's main dataset by matching Cook County Chicago census tracts to CPS student census tracts in which they live.

Descriptive Analyses

Descriptive statistics and analyses were performed using Stata 17.0. The means and standard deviations of continuous items and frequencies of categorical items were analyzed. Univariate normality was explored using tests of skewness (i.e., the degree and direction of asymmetry of a distribution) and kurtosis (i.e., the extent that data is peaked or flat in a distribution). Variables were created into quantiles to ensure skewed variables did not produce

biased results and were easier to interpret. No quantile variables indicated normality issues (see Appendix C).

Statistical Analyses

All statistical analyses were performed using Stata 17.0. Stata 17.0 was selected because of its ability to conduct multilevel analyses for binary outcomes and its capacity to use maximum likelihood (ML) estimation for multilevel models, which yields unbiased estimators. Multilevel modeling improves the estimates of the effects of independent variables by accounting for the random disturbance structure that transpires in a fully specified multilevel model and helps researchers understand the magnitude of variance across settings by evaluating the variation in dependent variable due to individual, school, or neighborhood, respectively (Fielding & Goldstein, 2006; Yuan & An, 2017). The Intraclass Correlation Coefficient (ICC) describes the proportion of variation observed that is not explained by predictors in the model that could be accounted for by clustering at the neighborhood or school level. For these analyses, clustering at both individual and neighborhood levels, and individual and school levels were considered if the ICC coefficient was significant using a 0.05 level of significance. This statistical approach recognized students residing in particular neighborhoods or schools may have shared similar characteristics and a shared risk for becoming overage for grade. If factors of being overage for grade were not independent of one another, then failure to account for the contextual effects of their neighborhood of residence or school they attended could produce biased risk estimates.

Two-level multilevel mixed-effects binary logistic regression models were used because the outcome (overage) was coded as a binary variable (0 = at-age; 1 = overage), and outcome (graduate) was coded as a binary variable (0 = did not graduate; 1 = graduate). In the models, Level 1 included individual-level factors to be controlled for in evaluating the odds of being

overage for grade. Level 2 included neighborhood factors examined as predictors on the odds of being overage for grade in specific Aim 1. In specific Aim 2, Level 2 included elementary school factors examined as predictors on the odds of being overage for grade. In specific Aim 3, Level 2 included high school climate factors examined as predictors on the odds of overage students graduating high school. See Table 3.1 for the organization of variables for multilevel modeling.

Table 3.1

Organization of Variables for Multilevel Modeling

Independent variables	Variable type	Source	Measurement
Individual-level variables			*q1-q4 indicating quartile number that a student falls into
Race	Categorical	CPS Data	White, Black/African American, Latine, Asian/Pacific Islander
Gender	Categorical	CPS Data	Male, Female
Suspensions	2-Quantile	CPS Data	q1: no suspensions; q2: > 1 suspension
Absences	Quartile	CPS Data	q1: 0–2 absences; q2: 2.5–5.5 absences, q3: 6–10.5 absences; q4: > 11 absences
NWEA test scores	Quartile	CPS Data	q1: scores between 84–99%; q2: between 70-83%; q3: scores between 52–67%; q4: scores between 1–50%
Failed courses	2-Quantile	CPS Data	q1: no failed courses; q1: > 1 failed course
Neighborhood-level variables			*q1–q4 indicating quartile number that a census tract falls into
Home and rental affordability	Quartile	Opportunity Index	q1: census tracts with 11–38% households paying more than 30% of household income for housing; q2: 38–45%; q3: 45–51%; q4: 51–71%
Home ownership	Quartile	Opportunity Index	q1: census tracts with 60–99% homeowners; q2: 45–60%; q3: 32–45%; q4: 0–32%

Table 3.1 Continued

Independent variables	Variable type	Source	Measurement
Green space	Quartile	Opportunity Index	q1: census tracts with 72–93% green space; q2: 66–72%; q3: 59–66%; q4: 13–59%
Access to supermarket	Tercile	Opportunity Index	q1: census tracts with less than 1% of households without a car located further than a half-mile from the nearest supermarket; q2: 1–5%; q3: more than 5%
Neighborhood poverty	Quartile	UChicago Consortium on School Research (geocoded to student addresses from the American Community Survey)	q1: census tracts w/ lowest level of poverty between -2.7 and -.2 standard deviations below the mean; q2: -.21–.3 *SD*; q3: .3–1 *SD*; q4: 1–4 *SD* above the *M* (highest poverty)
School-level variables			*q1–q4 indicating quartile number that a school falls into
School suspension rate (percentage)	2-Quantile	CPS Data	q1: schools with 0–1% suspension rate; q2: schools with > 1% suspension rate
Students' perception of school safety	Quartile	CPS Data	q1: schools with poorest perceptions of school safety, between -2 to -4 *SD* below the mean; q2: .5 to -2; q3: .6 to 2.4; q4: 2.4 to 4 above the *M* (highest perceptions of school safety)
Students' perception of student–teacher trust	Quartile	CPS Data	q1: schools with poorest perceptions of student–teacher trust, between -2 to -4 *SD* below the mean; q2: .5 to -2; q3: .6 to 2.4; q4: 2.4 to 4 above the *M* (highest perceptions of student–teacher trust).

Table 3.1 Continued

Independent variables	Variable type	Source	Measurement
Students' perception of racial equity climate	Quartile	CPS Data	q1: schools with poor REC, 1.5 to 2.5 *SD* above the mean; q2: schools w/ fair REC, 1 to 1.5 *SD*; q3: schools with good REC, -1 to -2 *SD*; q4: schools with great REC, -2 to -4 *SD* below the *M*
Students' perception of school civic engagement	Quartile	CPS Data	q1: schools with poor SCE, -1 to -2 *SD* below the *M*; q2: schools w/ fair SCE, -.1 to -1 sd; q3: schools with good SCE, 1 to 2 *SD*; q4: schools with great SCE, 2 to 4 *SD* above the *M*
School poverty	Quartile	UChicago Consortium on School Research (geocoded to student addresses from the American Community Survey)	q1: schools with lowest level of poverty between -1.7 and -.1 *SD* below the mean; q2: .1 to .2 *SD*; q3: .2 to 1 *SD*; q4: 1-2 *SD* above the *M* (highest school poverty)

Aim 1

Aim 1 was to learn who is most at risk of being retained in grade and how that risk is related to neighborhood disinvestments and assets.

Data Analytic Strategy for Aim 1a. Aim 1a was in which census tracts are CPS overage students entering ninth grade most concentrated? Analyses were conducted to provide descriptive information on the overage status (0 = at-age, 1 = overage) of CPS students first time freshman in Fall of 2012–2015 and the census tract in which they resided. This information was used to visually map how overage students were spatially distributed across Chicago. To begin the geocoding process, frequencies of total overage and at-age ninth graders for each census tract

were calculated. A tidy dataset was created from the student and census tract variables and exported as a CSV file, which was then uploaded to ArcGIS Online to turn it into an appropriate file for geographic information system (GIS) mapping. A tidy dataset is a standard method of displaying the data in the form of a data matrix in preparation for GIS mapping. The dataset was then geocoded and downloaded as a shapefile for use in QGIS 3.12. A spatial join in QGIS was then conducted with the 2010 census tract shapefile for Chicago. Finally, using QGIS, two-dimensional maps of Chicago were created to visualize the ratio of CPS student overage for grade to CPS students at-age in each census tract. Census tracts outlined in purple indicated census tracts with the lowest percentage of overage CPS students, and census tracts outlined in light blue indicated second lowest percentage of overage CPS students. Census tracts outlined in sky blue indicated third highest percentage of overage CPS students, standard blue indicated second highest percentage of overage students, and census tracts outlined in dark blue indicated census tracts with the highest percentage of overage CPS students.

Data Analytic Strategy for Aim 1b. Aim 1b was which neighborhood characteristics of assets and disinvestment are most related with the probability of being overage for grade? Such assets and disinvestment may be socioeconomic (i.e., neighborhood poverty); housing (i.e., home and rental affordability, home ownership rates); or social and institutional supports (i.e., access to supermarket and green space). Analyses conducted for the subsequent specific Aim 1b were designed to examine (a) the relation of neighborhood-level factors and the probability of being an overage student, and (b) the relation of neighborhood-level and individual-level factors and the probability of being an overage student. Drawing from prior neighborhood effects research and the transformative racial equity framework, the following neighborhood factors were included in the model: (a) affordable housing, (b) home ownership, (c) green space, (d) access to

supermarket, and (e) neighborhood poverty. Predictor variables were treated as quartiles based on the entire student sample and included in the final model (see Table 3.1 for explication of quartiles for each variable). Quartiles split the data into four even parts based on the entire sample of students (i.e., students in the top quartile of xyz). Quartiles are used to calculate the interquartile range, which is a measure of variability around the median. Specifically, quartiles broke down the data into quarters so that 25% of the measurements were less than the lower quartile, 50% were less than the median, and 75% were less than the upper quartile. This allowed, for instance, the examination between the first quartile or lowest 25th percentile of students living in census tracts with low homeowners and the fourth quartile or highest 25th percentile of students living in census tracts with the highest homeowners of the group. This also helped to identify at which point a variable had a significant impact on the outcome in comparison to the reference group (e.g., 40% homeowners vs. 60% homeowners). Because 50% of students fell in the upper quartile of neighborhoods with access to supermarket, STATA treated it as a tercile variable. Individual level variables (i.e., suspensions and failed classes) were treated as two-quantile variables (0 = 0, 1 = at least one suspension/one failed course).

Statistical analyses were performed using STATA 17.0. A two-level multilevel mixed-effects binary logistic regression model was estimated with no individual-level predictors to show the total variation by neighborhoods. Level 2 neighborhood variables were included in the model and examined as predictors on the odds of being overage for grade when accounting for clustering at the neighborhood level. There were 790 census tracts in which CPS students in the study sample lived, and 99.9% (67,711) of CPS students in the study sample were included in the analyses. There were less than 1% excluded cases with missing data (see Table 3.2). There were

between 1 and 398 students in the census tracts, with an average of 85.7 students per census tract.

Table 3.2

Percentage of Missing Data in Analytical Sample

Census tract	%
Unaffordable housing	0.12
Home ownership	0.12
Green space	0.12
Access to supermarket	0.12
Neighborhood poverty	0.12

Note. n = 792.

Subsequently, a two-level multilevel mixed-effects binary logistic regression model was estimated, simultaneously incorporating all individual- and neighborhood-level predictors when accounting for clustering at the neighborhood-level. The second model, with the individual-level predictors, showed how much the neighborhood variation was mediated through individual factors. Ninety-three percent (63,012) of CPS students in the study sample were included in the analyses. Excluded cases had missing data primarily from test scores (see Table 3.3). There were between 1 and 380 students in the census tracts, with an average of 80 students per census tract.

Table 3.3

Percentage of Missing Data in Analytical Sample

Student sample	%
Suspensions	0
Absences	0.01
Failed courses	2
Reading scores	4.3
Math scores	4.3

Note. n = 67,789.

Data Analytic Strategy Aim 1c

Aim 1c was do characteristics of identity such as race or sex relate to the probability of being overage for grade within and between neighborhoods? For instance, do neighborhoods with high proportions of Latine students have higher odds of students being overage for grade compared to neighborhoods with high proportions of white students (between effects)? When controlling for racial composition in the neighborhood, does a Latine student have higher odds of being overage for grade (within effects)? Sex was coded in binary terms with female used as the reference category (female = 0, male = 1). Racial categories were coded using four categories: non-Hispanic white (white), Black/African American (Black), Latino/Latina (Latine), and Asian/Pacific Islander (Asian), with white used as the reference category. All race and sex variables were standardized, and average neighborhood indicators of each sex and race category were created to examine between effects and how it relates to the mean of overage students. Students' sex and race categories were subtracted from the neighborhood average indicators of each category to examine within effects and how it relates to the odds of being overage.

Aim 2

Aim 2 was how is risk of being retained related to elementary school characteristics?

Data Analytic Strategy for Aim 2a. Aim 2a was which school characteristics (i.e., school poverty rate, student suspension rate, student perception of student–teacher trust, student perception of school safety) are linked to the probability of students being overage for grade? Analyses conducted for the subsequent specific Aim 2a were designed to examine (a) the relation of school-level factors and the probability of being an overage student, and (b) the relation of school-level and individual-level factors and the probability of being an overage student. Drawing from the framework developed by the Committee on Developing Indicators of Educational Equity and the Transformative Racial Equity Framework (The Transdisciplinary Resistance Collective for Research and Policy et al., 2020), the following school factors were included in the model: (a) school suspension rate, (b) school poverty rate, (c) student perception of student–teacher trust, (d) student perception of school safety, and (e) percentage of staff that identify as BIPOC. Predictor variables were treated as quartiles and included in the final model (see Table 3.1). School suspension rate was treated as a two-quantile variable (q1 = elementary schools with < 1% suspension rate, q2= elementary schools with > than 1% suspension rate); only 75 elementary schools fell in the second quantile, and 380 elementary schools fell in the first quantile.

Statistical analyses were performed using STATA 17.0. A two-level multilevel mixed-effects binary logistic regression model was estimated with no individual level predictors to show the total variation by elementary schools. Level 2 school level variables were only included in the model and examined as predictors of the odds of being overage for grade when accounting for clustering at the school level. There were 434 CPS elementary schools, and 97% (65,691) of

students in the study sample were included in the analyses. There were less than 3.2% excluded cases with missing data (see Table 3.4). There were between 1 and 1,140 students in elementary schools, with an average of 151 students per school.

Table 3.4

Percentage of Missing Data in Analytical Sample

Elementary school	%
School poverty	1.5
School safety	3,1
Student–teacher trust	3,1
Suspension rate	1,5

Note. $n = 442$.

Subsequently, a two-level multilevel mixed-effects binary logistic regression model was estimated, simultaneously incorporating all individual- and school-level predictors and accounting for clustering at the elementary school-level. The second model, with the individual-level predictors, showed how much school variation is mediated through individual factors. Ninety two percent (62,314) of CPS students in the study sample were included in analyses. Excluded cases had missing data primarily from test scores (see Table 3.3 from Aim 1b). There were between 1 and 1,040 students in elementary schools, with an average of 144 students per school.

Data Analytic Strategy for Aim 2b. Aim 2b was do characteristics of identity such as race or sex relate to the probability of being overage for grade within and between elementary schools? Sex was coded in binary terms with female used as the reference category (female = 0, male = 1). Racial categories were coded using four categories: non-Hispanic white (white), Black/African American (Black), Latino/Latina (Latine), and Asian/Pacific Islander (Asian), with white used as the reference category. All race and sex variables were standardized, and average elementary school indicators of each sex and race category were created to examine between effects and how it relates to the mean of overage students. Students' sex and race

categories were subtracted from the school average indicators of each category to examine within effects and how it related to the odds of being overage.

Data Analytic Strategy for Aim 2c

Aim 2c was how much variation of risk is explained by elementary school level and how much is explained by neighborhood level? First, a two-level multilevel mixed-effects binary logistic regression model (i.e., Model 1) was estimated for the odds of being overage, without any predictors and accounting for clustering at the school level. Second**,** a two-level multilevel mixed-effects binary logistic regression model (i.e., Model 2) was estimated for the odds of being overage, without any predictors and accounting for clustering at the neighborhood level. Third, a cross-classified multilevel mixed-effects binary logistic model (i.e., Model 3) was estimated for the odds of being overage, without any predictors and simultaneously accounting for clustering at the school and neighborhood level. It took approximately 1 hour to estimate the cross-classified multilevel model. The default estimation procedure was to fit the model using the expectation maximization algorithm until convergence, or until 20 iterations have been reached, whichever happens sooner. At that point, maximization switched to a gradient-based method using Newton-Raphson iterations.

Subsequently, a cross-classified multilevel mixed-effects binary logistic model simultaneously incorporating school- and neighborhood-level predictors and accounting for clustering at the school and neighborhood level was attempted. After checking for correlation and multicollinearity, both neighborhood- and school-level variables were included in the final model. The model ran for over 36 hours; however, the model was too large to be estimated. For this aim, the variation of risk of being overage explained by elementary school and neighborhood could only be interpreted without the covariates.

Aim 3

Aim 3 was which school characteristics relate to high school completion for students who begin high school as overage for grade?

Data Analytic Strategy for Aim 3a. Aim 3a was do civic engagement and racial equity climate in schools promote high school completion for overage students? Analyses conducted for the subsequent specific Aim 3a were designed to first examine (a) the relation of high school level school climate factors and the odds of graduating in 4 years for all students and (b) the relation of high school climate factors and the odds of graduating in 4 years for overage students (interaction effects). In all analyses, the dependent variable was binary: graduates or nongraduates. Graduates were students who started at CPS high schools and who graduated in 4 years from a CPS high school. Nongraduates were students who started at CPS high schools who left school without a diploma, students who transferred to a different district, and students who were still enrolled in school but had not yet received a high school diploma in 4 years. Drawing from the framework developed by the Committee on Developing Indicators of Educational Equity and the Transformative Racial Equity framework (The Transdisciplinary Resistance Collective for Research and Policy et al., 2020), the following school factors were included in the model: (a) racial equity school climate, and (b) school civic engagement. Only ninth grade cohorts 2013–2015 (n = 44,742) were included in the analyses; both school civic engagement and racial equity climate variables were not available in the 5Essential survey for the 2012 cohort. Predictor variables were treated as quartiles and included in the final model (see Table 3.1).

Statistical analyses were performed using STATA 17.0. A two-level multilevel mixed-effects binary logistic regression model was estimated. Level 2 school climate variables were

included in the model and examined as predictors of the odds of graduating high school in 4 years and accounting for clustering at the school level. Ninety six CPS high schools and 97% (43,564) of students in the study sample for Cohorts 2013–2015 were included in the analyses. There were 6.8% excluded cases with missing data resulting in a loss of seven high schools (see Table 3.5). There were between 1 and 1,983 students in high schools with an average of 383 students per school.

Table 3.5

Percentage of Missing Data in Analytical Sample for Cohorts 2013–2015

High school	%
Racial equity climate	6.8
School civic engagement	6.8

Note. $n = 103$.

Subsequently, two separate two-level multilevel mixed-effects binary logistic regression models were estimated that included interaction effects of racial equity school climate and overage, and school civic engagement and overage when accounting for clustering at the school level.

Data Analytic Strategy for Aim 3b. Aim 3b was do they reduce the difference in graduation rates for retained students compared to students at grade level differentially based on race and sex? Sex was coded in binary terms with female used as the reference category (female = 0, male = 1). Racial categories were coded using four categories: non-Hispanic white (white), Black/African American (Black), Latino/Latina (Latine), and Asian/Pacific Islander (Asian), with white used as the reference category. All race and sex variables were standardized, and

average high school indicators of each sex and race category were created. Three-way interaction effects were created between race/sex, overage, and racial equity climate/school civic engagement. Four separate two-level multilevel mixed-effects binary logistic regression models were estimated that included two-way and three-way interaction effects of race, overage, and racial equity school climate (i.e., Model 1), race, overage, and school civic engagement (i.e., Model 2), sex, overage, racial equity school climate (i.e., Model 3), and sex, overage, and school civic engagement (i.e., Model 4), when accounting for clustering at the high school-level.

Chapter 4: Results

Descriptive Analyses Results

Descriptive characteristics of the analytic sample are provided in Table 4.1. There were a total of 67,789 first-time ninth graders who graduated from a Chicago Public School (CPS) elementary school and attended a CPS high school between the years 2012–2015. Forty-nine point eight percent of the sample were male and 50.2% of the sample were female. Thirty-five point eight percent of the student sample identified as Black/African, 50.7% identified as Latine, 9.02% identified as white, and 4.4% identified as Asian/Pacific Islander.

Table 4.1

Descriptive Characteristics of Analytical Sample for Total Ninth Grade Cohorts 2012–2015

Variable	Measure/category	n	%
Sex	Male	33,755	49.8
	Female	34,034	50.2
Race	white	6,021	9.02
	Black/African American	23,911	35.8
	Latine	33,899	50.7
	Asian/Pacific Islander	2,937	4.4

Note. $n = 67,789$.

Descriptive characteristics of the analytic sample for overage students are shown in Table 4.2. Fourteen point eight percent of the total sample were overage students between the years 2012–2015. Fifty-seven point six percent of overage students were male and 42.4% were female. Fifty-five percent of overage students identified as Black/African, 38.1% identified as Latine, 4.7% identified as white, and 2.2% identified as Asian/Pacific Islander.

Table 4.2

Descriptive Characteristics of Analytical Sample for Overage Ninth Grade Cohorts 2012–2015

Variable	Measure/category	n	%
Overage		10,014	14.8
Sex	Male	5,784	57.6
	Female	4,230	42.4
Race	white	461	4.7
	Black/African American	5,453	55
	Latine	3,781	38.1
	Asian/Pacific Islander	222	2.2

Note. n = 10,014

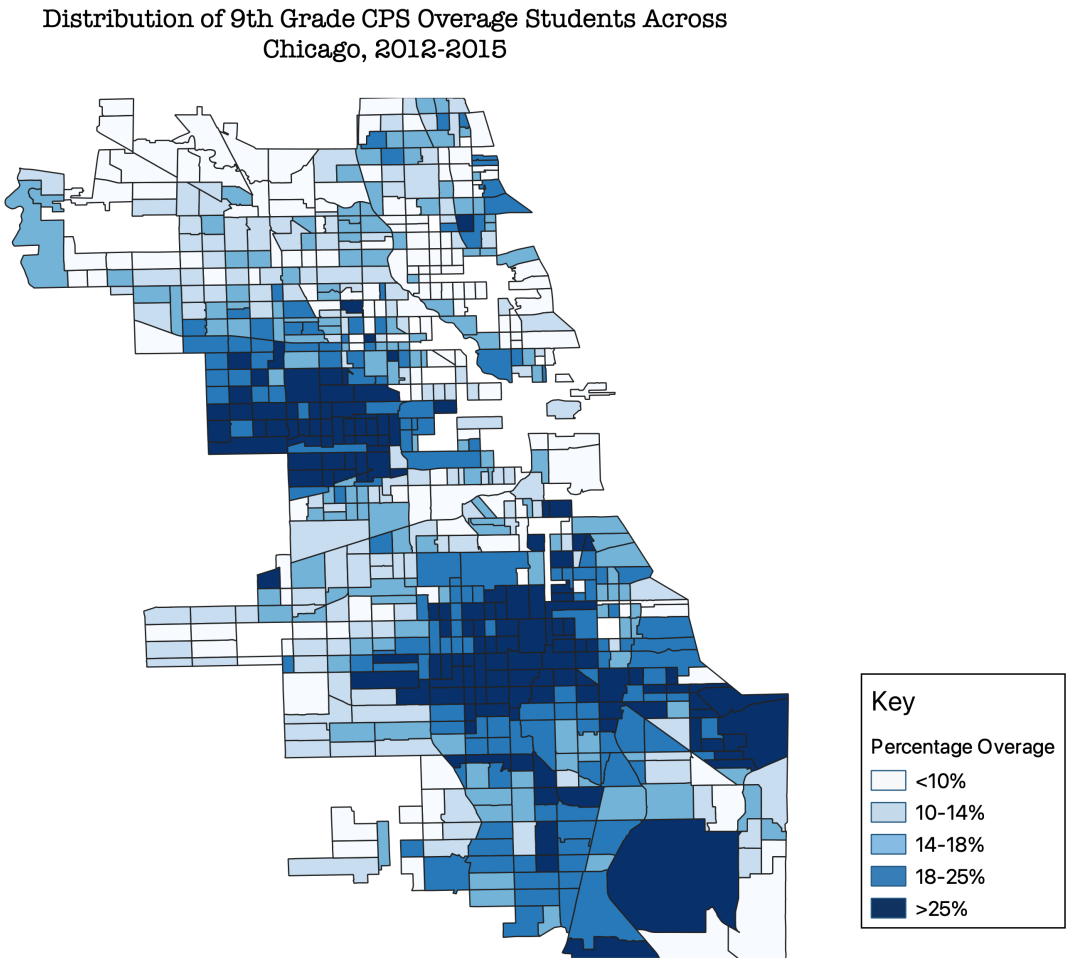
Specific Aim 1a Results

The map in Figure 4.1 shows the spatial distribution of ninth grade CPS overage students across Chicago neighborhoods, bounded by census tracts, between 2012 and 2015. This map provides a visual point of comparison to examine where the highest versus lowest percentage of overage students were concentrated. A percentage of total number of overage students in each census tract was created by taking the ratio of the total number of CPS overage students entering ninth grade for the first-time over the total number of first-time ninth grade CPS students in that census tract, times 100. Quintile groups were created using the percentage of overage students in census tracts. Group 1 consisted of census tracts with the lowest percentage (< 10%) of CPS ninth graders who were overage for grade in the years 2012–2015. Group 2 consisted of census tracts with the second lowest percentage (10%–14%) of CPS ninth graders who were overage for grade in the years 2012–2015. Group 3 consisted of census tracts with moderate percentage (14%–18%) of CPS ninth graders who were overage for grade in the years 2012–2015. Group 4 consisted of census tracts with the second highest percentage (18%–25%) of CPS ninth graders

who were overage for grade in the years 2012–2015. Group 5 consisted of census tracts with the highest percentage (> 25%) of CPS ninth graders who were overage for grade in the years 2012–2015. In the map, the darkest-shaded blue areas represent neighborhoods with the highest percentage of overage students whereas the lightest-shaded blue areas represent neighborhoods with the lowest percentage of overage students. As evidenced in this map, census tracts with the highest percentage of overage students were concentrated on the west and south sides of Chicago.

Figure 4.1

*Distribution of N*inth *Grade CPS Overage Students Across Chicago, 2012–2015*



Tables 4.3 and 4.4 provide a list of the top 10 census tracts with the highest percentage of CPS overage students entering ninth grade in the years 2012–2015 (see Table 4.3) and the top 10 census tracts with the lowest percentage of CPS overage students entering ninth grade in the years 2012–2015 (see Table 4.4). The tables also include descriptive neighborhood level variables that were used for multilevel analysis in Aim 1b. As there was limited variation in the neighborhood characteristics in each table, there was remarkable difference in neighborhood factors between census tracts with the highest and lowest percentage of overage students. The most notable observation was a few census tracts between the two groups shared similar levels of neighborhood poverty, yet produced vastly different percentage of overage students. Percentage of home ownership and unaffordable housing appeared as the most salient differences between the two groups, which is further examined in Aim 1b.

Table 4.3

Top 10 Census Tracts With Highest Percentage of Overage Students

Census tract	Community area	Overage students (%)	Home ownership rate (%)	(Un) affordable housing (%)	(Limited) access to supermarket (%)	Green space (%)	Neighborhood poverty (*SD* above *M)*
8368	East Garfield Park	38	19	67	34.8	68.5	1
6811	Englewood	37	14	66.9	25.7	58.4	.9
4005	Washington Park	36	15	54.8	0	67.5	1.05
8415	North Lawndale	36	22	60.9	17.7	61.1	1.6
4207	Woodlawn	36	17	63.8	0	58.3	2.1
4008	Washington Park	35	4.2	46.7	0	65	1.5
8387	North Lawndale	35	15.9	56.4	0	60.6	1.1
6904	Great Grand Crossing	35	25.2	60.8	5	58.5	.003
6809	Englewood	34	10.8	57	19	59.5	.9
6812	Englewood	33	20	62	0	51.5	1.4

Table 4.4

Top 10 Census Tracts With Lowest Percentage of Overage Students

Census tract	Community area	Overage students (%)	Home ownership rate (%)	(Un) affordable housing (%)	(Limited) access to supermarket (%)	Green space (%)	Neighborhood poverty (*SD* below *M)*
170	Dunnin	2	84	32	5	58	-.3
0902	Edison Park	3	75	19	.4	53.5	-.8
120	Forest Glen	3.7	84	29.8	0	37	-.7
1203	Forest Glen	3.8	93	21	1.8	47	.2
1704	Dunning	4	75	36	1.8	63	. 3
0505	North Center	4.4	51	28	.2	69	-1.6
8401	Bridgeport	5.4	43	48	0	83	1
1406.01	Albany Park	5.7	41	42	0	68	.7
1001	Norwood Park	5.8	66	31	.1	64	-.3
1404	Albany Park	5.9	64	34	0	65	.3

Specific Aim 1b Results

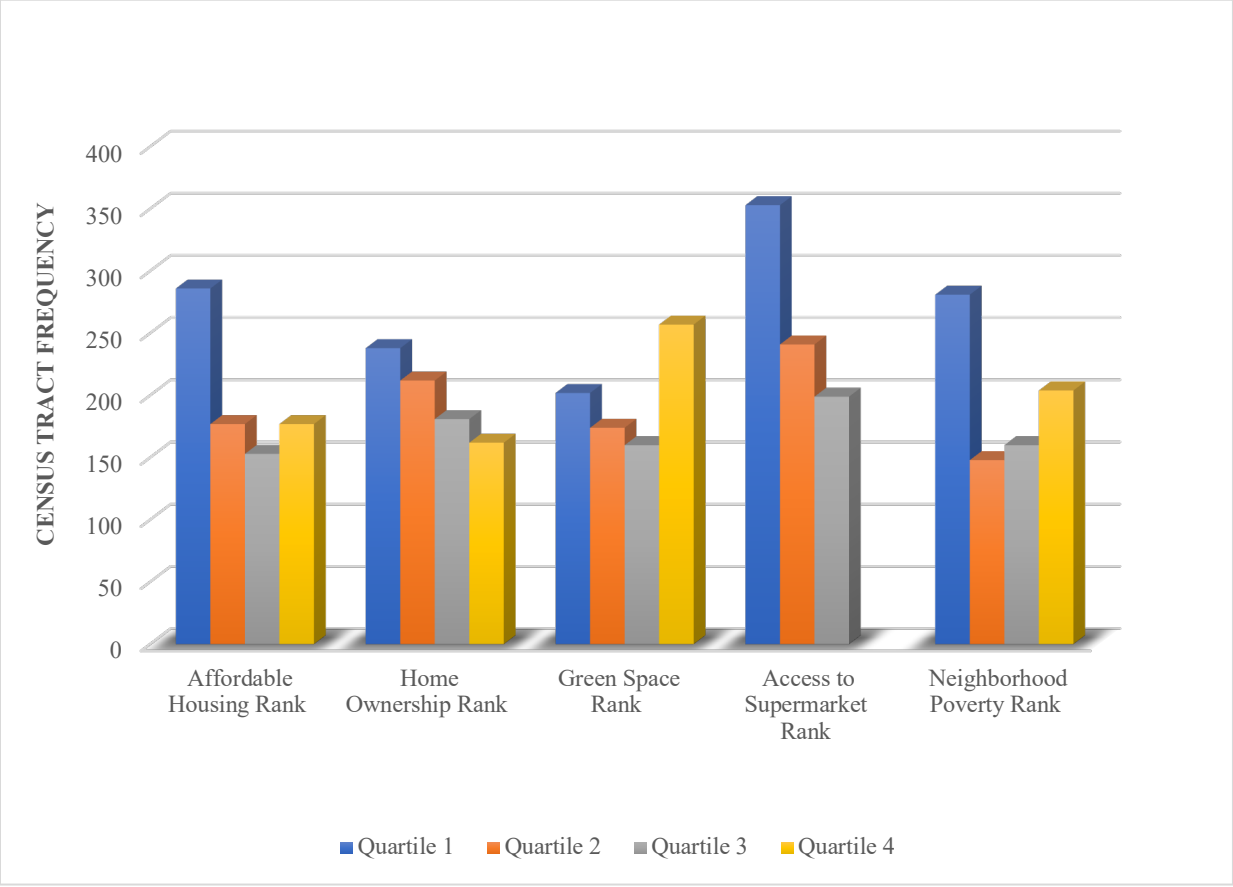
Neighborhood-level characteristics most related with the probability of being overage for grade.

The results of descriptive analyses and GIS mapping found ninth grade CPS overage students clustered in census tracts predominantly on the west and south side of Chicago in 2012–2015. The next set of analyses were performed using multilevel mixed-effects binary logistic regression models to gain a richer understanding of neighborhood level variables at the census tract level and their effect on overage students. Specifically, analyses were performed to examine (a) the relation of neighborhood-level characteristics on the probability of being overage for grade, and (b) the relation of neighborhood- and individual-level factors on the probability of being overage for grade. The following neighborhood-level factors were included in the model as quantile variables: (a) affordable housing, (b) home ownership, (c) green space, (d) access to supermarket, and (e) neighborhood poverty. Each of these variables were measured at the level

of the census tract. See Figure 4.2 for census tract frequency for each neighborhood rank variable and Figure 4.3 for student sample frequency, at-age and overage, for each neighborhood rank variable. The following individual-level variables were included in the model: (a) NWEA Reading Percentile, (b) NWEA Math Percentile, (c) absences, (d) suspensions, and (e) failed courses. In both sets of analyses, the dependent variable is binary: overage or at-age.

Figure 4.2

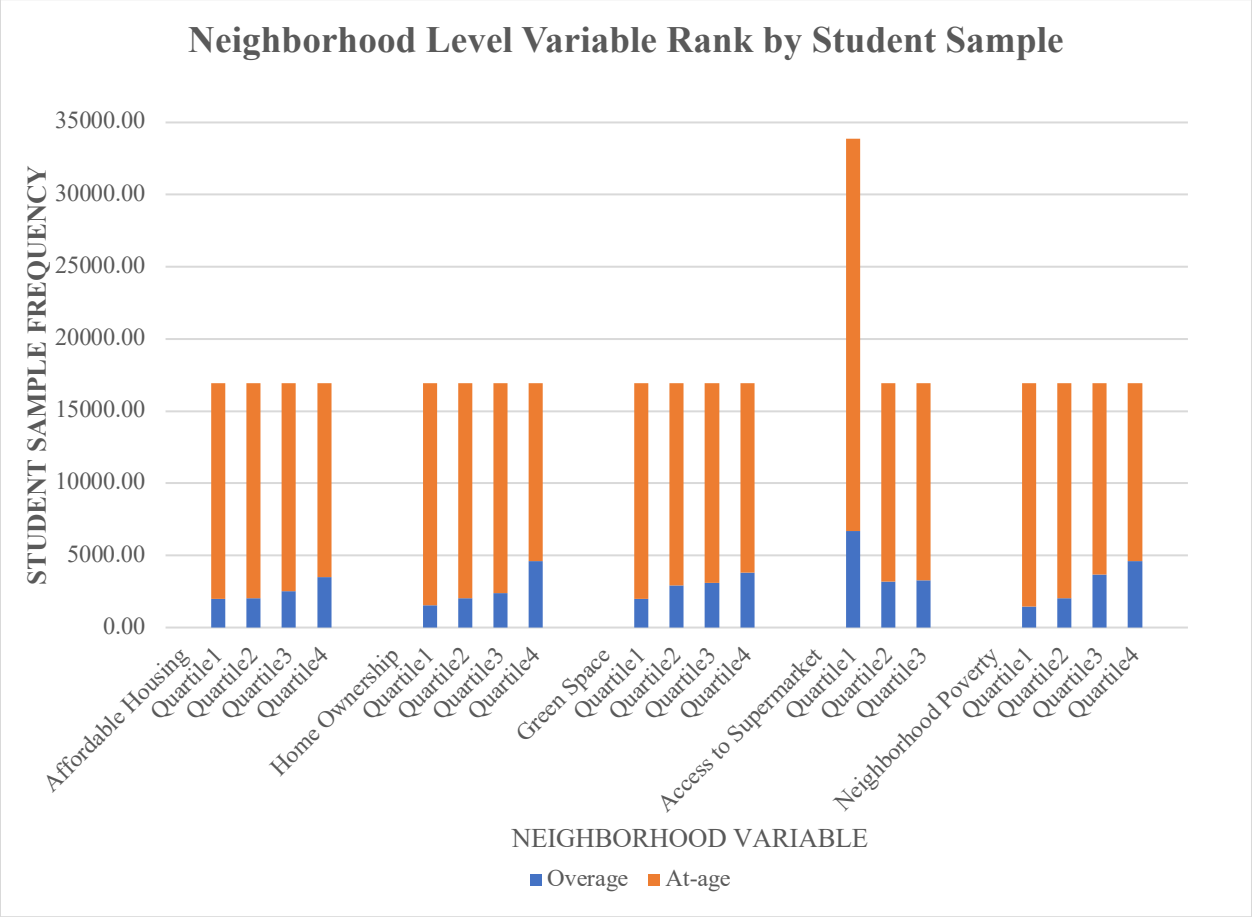
Summary of Neighborhood Rank Variable by Census Tract Frequency



Note. Predictor variables were treated as quartiles based on the entire student sample. See Table 3.1 for explication of quartiles; Quartile 1 highest, Quartile 4 lowest for all neighborhood variables except Neighborhood Poverty (Quartile 1 lowest, Quartile 4 highest).

Figure 4.3

Summary of Neighborhood Variable Rank by At-Age and Overage Student Sample



Note. Quartiles split the data into four even parts based on the entire sample of students (i.e., students in the top quartile of xyz). Because 50% of students fell in the upper quartile of neighborhoods with access to supermarket, STATA treated it as a tercile variable. See Table 3.1 for explication of quartiles; Quartile 1 highest, Quartile 4 lowest for all neighborhood variables except Neighborhood Poverty (Quartile 1 lowest, Quartile 4 highest).

Before proceeding with the multilevel mixed-effects binary logistic regression model, each individual- and neighborhood-level variable was examined in isolation of the other variables. When examined individually, each variable was a statistically significant predictor ($p < 0.001$) of students' odds of being overage for grade. Each variable was then checked for strong

correlations with other variables in the model. There was no strong correlation in the model. Highest values of correlation were .4; values between .3 and .49 were considered medium correlation (R. Taylor, 1990). As previous research suggested, these variables were interconnected, multicollinearity diagnostics were run for all neighborhood-level variables and entered simultaneously in the model, and the variance inflation factor statistic for each variable is indicated in Table 4.5. The results did not provide any strong indicators of multicollinearity among neighborhood-level variables.

Table 4.5

Summary of Diagnostic Tests for Multicollinearity Neighborhood-Level Variables

Variable	Variance inflation factor
Affordable housing	1.60
Home ownership	1.75
Green space	1.24
Access to supermarket	1.19
Neighborhood poverty	1.45

A multilevel mixed-effects binary logistic regression model was estimated with only neighborhood-level predictors on the odds of being overage (i.e., Model 1). A likelihood-ratio test was conducted comparing the current model with a random cluster effect at the neighborhood level to an ordinary logistic model with no neighborhood effects and reports a *p* value that was effectively zero ($p < 0.001$). This indicated the variance in mean of overage status at the neighborhood level was highly significant and the multilevel approach was favored over the ordinary logistic model that did not account for clustering (assumed cases were uncorrelated in clusters). The intraclass correlation for Model 1 (ICC = 0.05) suggested an appreciable clustering of overage students in neighborhoods, suggesting 5% of variability in overage was

attributable to neighborhoods over and above the effects of the covariates in the model; 9% of the variability was attributable to neighborhoods without controlling for the neighborhood variables.

A multilevel mixed-effects binary logistic regression model was then estimated with individual-level predictors on the odds of being overage (i.e., Model 2). A likelihood-ratio test was conducted comparing the current model to a fixed effects model with no neighborhood effects and reported a p value that was effectively zero ($p < 0.001$). This, again, indicated the variance in mean of overage status at the neighborhood level was highly significant and the multilevel approach was favored over the ordinary logistic model, which did not account for clustering. Despite individual level factors included in the model, the intraclass correlation (ICC = 0.05) remained the same as Model 1, showing that 5% of variability in being overage for grade was attributable to neighborhoods over and above the effects of the covariates in the model. This suggested the unexplained neighborhood differences in being overage (i.e., those not represented by neighborhood variables in the model) did not influence overage rates through student achievement, but through other mechanisms.

The multilevel mixed-effects binary logistic regression models are presented in Table 4.6, including adjusted odds ratios (AOR) and 95% confidence intervals (95% CI) of the factors associated with the odds of being overage. Significant results are highlighted in the table.

Table 4.6

Multilevel Mixed-Effects Logistic Regression Models, Including Adjusted Odds Ratios

Factors in quartiles	Neighborhood structural factors (Model 1)	Neighborhood structural factors w/ individual level factors (Model 2)
	*AOR*e [95% CI]	*AOR*e [95% CI]
Intercept	0.08 [0.07, 0.09]	0.05 [0.03, 0.06]
Home and rental affordability (ref: census tracts with 11–38% households paying more than 30% of household income for housing)		
q2: census tracts: 38 to 45%	**1.20 [1.10, 1.31]**	1.10 [0.99, 1.21]
q3: census tracts: 45 to 51%	**1.38 [1.26, 1.53]**	**1.19 [1.06, 1.32]**
q4: census tracts: 51 to 71%	**1.67 [1.51, 1.84]**	**1.40 [1.25, 1.56]**
Home ownership (ref: census tracts with 60–99% of homeowners)		
q2: census tracts: 45 to 60%	**1.26 [1.15, 1.39]**	1.17 [0.99, 1.29]
q3: census tracts: 32 to 45%	**1.38 [1.24, 1.53]**	**1.26 [1.11, 1.42]**
q4: census tracts: 0 to 32%	**1.56 [1.41, 1.73]**	**1.37 [1.20, 1.54]**
Green space (ref: census tracts with 72-93% green space)		
q2: census tracts: 66 to 72%	1.07 [0.98, 1.17]	1.05 [0.89, 1.17]
q3: census tracts: 59 to 66%	**1.29 [1.18, 1.41]**	**1.28 [1.16, 1.42]**
q4: census tracts: 13 to 59%	**1.37 [1.24, 1.49]**	**1.36 [1.24, 1.52]**
Access to Supermarket (ref: census tracts with less than 1% households without a car located further than a half-mile from the nearest supermarket)		
q2: census tracts: 1- 5%	0.92 [0.84, 1.02]	0.92 [0.83, 1.03]
q3: census tracts: more than 5%	**1.16 [1.08, 1.25]**	1.15 [0.99, 1.25]
Neighborhood Poverty (ref: census tracts with lowest level of poverty between -2.7 and -.2 standard deviations below the mean)		
q2: census tracts: between -.21 and .3 SD	1.10 [0.98, 1.23]	0.99 [0.91, 1.07]
q3: census tracts: between .3 and 2 SD	**1.15 [1.07, 1.23]**	1.02 [0.93, 1.11]
q4: census tracts: between 2 and 4 SD above the mean (highest poverty)	**1.51 [1.40, 1.63]**	**1.32 [1.20, 1.44]**
NWEA Reading Percentile (ref: students who scored between 84-99%)		
q2: students who scored between 70-83%		**1.41 [1.27, 1.56]**
q3: students who scored between 52-67%		**2.03 [1.84, 2.26]**
q4: students who scored between 1-50%		**2.87 [2.58, 3.19]**
NWEA Math Percentile (ref: students who scored between 84-99%)		
q2: students who scored between 70-83%		**1.59 [1.44, 1.77]**
q3: students who scored between 52-67%		**2.37 [2.14, 2.62]**
q4: students who scored between 1-50%		**3.42 [3.08, 3.80]**

Table 4.6 Continued

Factors in quartiles	Neighborhood structural factors (Model 1)	Neighborhood structural factors w/ individual level factors (Model 2)
	*AOR*e [95% CI]	*AOR*e [95% CI]
Absences (ref: 0-2 absences)		
q2: students with 2.5 - 5.5 absences		**1.20 [1.11, 1.29]**
q3: students with 6 – 10.5 absences		**1.33 [1.24, 1.43]**
q4: students with > 11 absences		**1.88 [1.76, 2.02]**
Suspensions (ref: no suspensions)		
q2: students with at least 1 suspension		**1.35 [1.27, 1.43]**
Failed Courses (ref: no failed course)		
q2: students with at least 1 failed course		**1.51 [1.43 1.60]**

Note. Bold denotes $p < 0.05$. *AOR* = adjusted odds ratio, *95% CI* = 95% confidence interval, *Ref* reference group.

All results discussed next describe the relation of neighborhood structural factors (i.e., Model 1) and neighborhood structural factors with individual level factors (i.e., Model 2) on the odds of being overage from Table 4.6.

Home and Rental Affordability

Home and rental affordability was described as the percentage of households paying more than 30% of household income for housing. Students who lived in census tracts with the highest percentage of unaffordable housing (i.e., Quartile 4) were at higher odds of being overage (q4; AOR = 1.67; 95% CI [1.51, 1.84]), compared to students who lived in census tracts with the lowest percentage of unaffordable housing. This meant students who lived in census tracts with greater than 51% of households paying more than 30% of their income on housing had 1.67 times greater odds of being overage at a rate of 12%, compared to students who lived in census tracts with the lowest percentage of unaffordable housing. Students who lived in census

tracts that were in Quartile 3 or Quartile 2 were also at higher odds of being overage (q3; AOR = 1.38; 95% CI [1.26, 1.53]) and (q2; AOR = 1.20; 95% CI [1.10, 1.31]), compared to students who lived in census tracts with the lowest percentage of unaffordable housing. Although Quartiles 3 and 2 had much lesser odds than Quartile 4, findings suggested census tracts with anything above 38% of households paying more than 30% of their income on housing had higher rates of overage students than census tracts with less than 38%.

The following results show the relation of home and rental affordability on the probability of being overage for grade with individual-level predictors (i.e., Model 2). These predictors were considered the most prominent education related factors to determining whether a student gets retained or not. In this model, accounting for individual-level predictors, the odds ratio decreased across quartiles, and only Quartiles 3 and 4 of home and rental affordability were significant predictors of the odds of being overage for grade, compared to Model 1 without the individual predictors. These findings suggested census tracts with anything above 45% of households paying more than 30% of their income on housing had higher rates of overage students than census tracts with less than 38% of households. It is important to note that despite accounting for these individual-level factors that were germane to determining a student's overage status, Quartiles 3 and 4 remained significant and showed higher odds of overage (q3; AOR = 1.19; 95% CI [1.06, 1.32]; q4; AOR = 1.40; 95% CI [1.25, 1.56]), with overage rates of 6% for Quartile 3 and 7% for Quartile 4, compared to census tracts in Quartile 1.

Home Ownership

Home ownership was described as the percentage of homeowners in each census tract. Students who lived in census tracts with the lowest percentage of homeowners (i.e., Quartile 4) were at higher odds of being overage (q4; AOR = 1.56; 95% CI [1.11, 1.73]), compared to

students who lived in census tracts with the highest percentage. This means students who lived in census tracts with less than 32% of homeowners had 1.56 times greater odds of being overage at a rate of 11%, compared to students who lived in census tracts with the highest percentage of homeowners. Students who lived in census tracts that were in Quartiles 3 or 2 were also at higher odds of being overage (q3; AOR = 1.38; 95% CI [1.24, 1.53]; q2; AOR = 1.26; 95% CI [1.10, 1.31]), compared to students who lived in census tracts with the highest percentage of homeowners. Although Quartiles 3 and 2 had much lower odds than Quartile 4, findings suggested census tracts with anything less than 60% of homeowners had higher rates of overage students than census tracts with at least 60% homeowners.

The following results show the relation of home ownership on the probability of being overage for grade with individual-level predictors. In Model 2, accounting for individual-level predictors, the odds ratio decreased across quartiles, and only Quartiles 3 and 4 of home ownership were significant predictors on the odds of being overage for grade, compared to Model 1 without the individual predictors. These findings suggested census tracts with less than 45% of homeowners had higher rates of overage students than census tracts with at least 60% homeowners. It is important to note that despite accounting for individual-level factors that held significant value in determining whether a student got held back, Quartiles 3 and 4 remained significant and showed higher odds of students being overage (q3; AOR = 1.26; 95% CI [1.11, 1.54]; q4; AOR = 1.37; 95% CI [1.20, 1.54]), with overage rates of 6% for Quartiles 3 and 4, compared to census tracts in Quartile 1.

Green Space

Green space was measured as the percentage of access to green space in each census tract. Students who lived in census tracts with the lowest percentage of green space (i.e., Quartile

4) and second lowest (i.e., Quartile 3) were at higher odds of being overage (q4; AOR = 1.37; 95% CI [1.24, 1.49]; q3; AOR = 1.29; 95% CI [1.18, 1.41]), compared to students who lived in census tracts with the highest percentage. This means students who lived in census tracts with less than 59% access to greenspace had 1.37 times greater odds of being overage at a rate of 10% and student with 59%–66% access to greenspace had 1.29 times greater odds of being overage at the rate of 9%, compared to students who lived in census tracts with the highest percentage of greenspace.

The following results show the relation of green space on the probability of being overage for grade with individual-level predictors (i.e., Model 2). The odds ratio across quartiles remained consistent with Model 1 without the individual predictors. These findings suggested despite accounting for individual-level education factors, Quartile 3 and Quartile 4 remained significant and showed higher odds of students being overage (q3; AOR = 1.28; 95% CI [1.16, 1.42]; q4; AOR = 1.36; 95% CI [1.24, 1.52]), compared to census tracts in Quartile 1.

Access to Supermarket

Access to supermarket was measured as the percentage of households without a car located further than a half mile from the nearest supermarket. Students who lived in census tracts with the highest percentage of (limited) access to supermarket (i.e., Quartile 3) were at higher odds of being overage (q4; AOR = 1.16; 95% CI [1.08, 1.25]) compared to students who lived in census tracts with the lowest percentage. This means students who lived in census tracts with at least 5% of households without a car located further than a half mile from the nearest supermarket had 1.16 times greater odds of being overage at a rate of 8%, compared to students who lived in census tracts with the lowest percentage of (limited) access to supermarket.

The following results show the relation of access to supermarket on the probability of being overage for grade with individual-level predictors (i.e., Model 2). The highest percentage of census tracts with (limited) access to supermarket (i.e., Quartile 3) was no longer significant in this model. The coefficient changed only slightly in Model 2. The variable did not have strong significance in Model 1 and so the slight decrease led it to be nonsignificant in Model 2. This finding suggested access to supermarket was not a strong explanatory variable in the model.

Neighborhood Poverty

Neighborhood poverty was described as the level of poverty in each census tract, estimated as standard deviations above and below the mean (higher is worse). Students who lived in census tracts with the highest percentage of neighborhood poverty (i.e., Quartile 4) and second highest (i.e., Quartile 3) were at higher odds of being overage (q4; AOR = 1.51; 95% CI [1.40, 1.63]; q3; AOR = 1.15; 95% CI [1.07, 1.23]), compared to students who lived in census tracts with the lowest level of poverty. This means students who lived in census tracts between 2 and 4 standard deviations above the mean had 1.51 times greater odds of being overage at a rate of 11% and students who lived in census tracts between .3 and 2 standard deviations above the mean had 1.15 times greater odds of being overage at a rate of 8%, compared to students who lived in census tracts with lowest poverty level.

The following results show the relation of neighborhood poverty on the probability of being overage for grade with individual-level predictors (i.e., Model 2). In this model, the odds ratio decreased across quartiles, and only Quartile 4 was a significant predictor on the odds of being overage for grade. These findings suggested after accounting for individual-level education factors, only census tracts with the highest level of poverty were associated with greater odds of

overage students (AOR = 1.32; 95% CI [1.20, 1.44]) with overage rates of 6%, compared to census tracts with lowest poverty.

Individual-Level Predictors

Model 2 was the multilevel mixed-effects binary logistic regression model estimated with both neighborhood-level and individual-level predictors on the odds of being overage. The following individual-level variables were included in the model as they were considered prominent factors that can lead to student retention: (a) NWEA reading percentile, (b) NWEA math percentile, (c) absences, (d) suspensions, and (e) failed courses.

Using the following results from Model 2, Table 4.6 describes the relation of these individual level predictors on the probability of being overage for grade. All students who scored below the 83 percentile on the NWEA reading exam were at greater odds of being overage for grade. Students in Quartile 2 (i.e., 70–83 percentile) had 1.41 times greater odds (95% CI [1.27, 1.56]) of being overage at a 7% rate, students in Quartile 3 (i.e., 52–67 percentile) had 2.03 times greater odds (95% CI [1.84, 2.26]) of being overage at a 9% rate, and students in Quartile 4 (i.e., 1–50 percentile) had 2.87 times greater odds (95% CI [2.58, 3.19]) of being overage at a 13% rate, compared to students in Quartile 1 with the highest percentile. Additionally, results suggested the NWEA math exam was associated with higher odds of being overage for grade. Students in Quartile 2 (i.e., 70–83 percentile) had 1.59 times greater odds (95% CI [1.44, 1.77]) of being overage at a 7% rate, students in Quartile 3 (i.e., 52–67 percentile) had 2.37 times greater odds (95% CI [2.14, 2.62]) of being overage at a 11% rate, and students in Quartile 4 (i.e., 1–50 percentile) had 3.42 times greater odds (95% CI [3.08, 3.80]) of being overage at a 15% rate, compared to students in Quartile 1 with the highest percentile.

Student absences were also associated with odds of being overage. The reference group for absences were students with zero to two absences. Students in Quartile 2 (i.e., 2.5–5.5 absences) had 1.20 times greater odds (95% CI [1.11, 1.29]) of being overage at a 6% rate, students in Quartile 3 (i.e., 6–10.5 absences) had 1.33 times greater odds (95% CI [1.24, 1.43]) of being overage at a 6% rate, and students in Quartile 4 (i.e., > 11 absences) had 1.88 times greater odds (95% CI [1.76, 2.02]) of being overage at a 9% rate, compared to students in Quartile 1 with the lowest absences.

Suspensions and having failed a course in eighth grade were associated with higher odds of being overage. For instance, students with at least one suspension had 1.35 times greater odds (95% CI [1.27, 1.43]) of being overage at the rate of 6% and students with at least one failed course were at 1.51 times greater odds (95% CI [1.43, 1.60]) of being overage at a rate of 7%, compared to student with zero suspensions or failed courses.

Specific Aim 1c Results

The characteristics of student identity (i.e., race and sex) most related to the probability of being overage for grade within and between neighborhoods.

The next set of analyses were performed to examine within and between neighborhood effects on the probability of being overage for grade as they relate to race and sex. The results of the multilevel mixed-effects binary logistic regression model of the within and between neighborhood effects controlling for all student and neighborhood covariates in the model are presented in Table 4.7. Significant results are highlighted in the table.

Table 4.7

Multilevel Mixed-Effects Logistic Regression Models for Between and Within Neighborhood Effects for Race and Sex

Between neighborhood effects for race and sex	*AOR*[e] [95% CI]	Within neighborhood effects for race and sex	*AOR*[e] [95% CI]
Sex: male (ref: female)	1.09 [0.89, 1.35]	Sex: male (ref: female)	**1.13 [1.11 1.16]**
Race/ethnicity (ref: white)		Race/ethnicity (ref: white)	
Black/African American	**1.64 [1.44, 1.86]**	Black/African American	**1.23 [1.15, 1.32]**
Latine	**1.17 [1.02, 1.34]**	Latine	0.94 [0.88, 1.01]
Asian/Pacific Islander	**1.14 [1.03, 1.26]**	Asian/Pacific Islander	1.03 [0.99, 1.08]

Note. Bold denotes $p < 0.05$. *AOR* = adjusted odds ratio, *95% CI* = 95% confidence interval, *Ref* = reference group.

Results from Table 4.7 show between effects for Black, Latine, and Asian, suggesting that living in neighborhoods with high proportion of Black students, high proportion of Latine students, or high proportion of Asian/Pacific Islander students were related to higher odds of being overage for grade (Black; AOR = 1.64; 95% CI [1.44, 1.86]; Latine; AOR = 1.17; 95% CI [1.02, 1.34]; Asian/Pacific Islander; AOR = 1.14; 95% CI [1.03, 1.26]), compared to living in neighborhoods with high proportion of white students. Results from Table 4.7 also show within effects for Black, suggesting that Black students had higher odds of being overage for grade controlling for the racial composition of the neighborhood (AOR = 1.23; 95% CI [1.15, 1.32]). Lastly, significant within effects for males suggested male students relative to females have higher odds of being overage for grade (AOR = 1.13; 95% CI [1.11, 1.16]).

Summary of Key Findings for Aim 1

Several key findings emerged from these analyses:

- Census tracts with the highest percentage of ninth grade CPS overage students in 2012–2015 were spatially concentrated on the west and south sides of Chicago.

- Clustering was found at the neighborhood level in both models with and without individual predictors, suggesting the variability in overage outcome was attributable to neighborhoods, and the multilevel approach was favored over the ordinary logistic model that did not account for clustering.
- Unaffordable housing, home ownership, neighborhood poverty, access to supermarket, and green space were all associated with the odds of being overage for grade. Each variable differed on the quartiles that were significant; however, Quartile 4 across all variables was associated with greater odds of being overage in comparison to the reference group.
- After accounting for individual-level variables, only Quartiles 3 and 4 for unaffordable housing, home ownership, and green space were significant, only Quartile 4 was significant for neighborhood poverty, and access to supermarkets was no longer significant.
- All individual-level variables in the model were associated with higher odds of being overage for grade compared to the reference group.
- Controlling for racial composition of the neighborhood, Black students had higher odds of being overage for grade. Male students relative to female students had higher odds of being overage for grade.

Specific Aim 2a Results

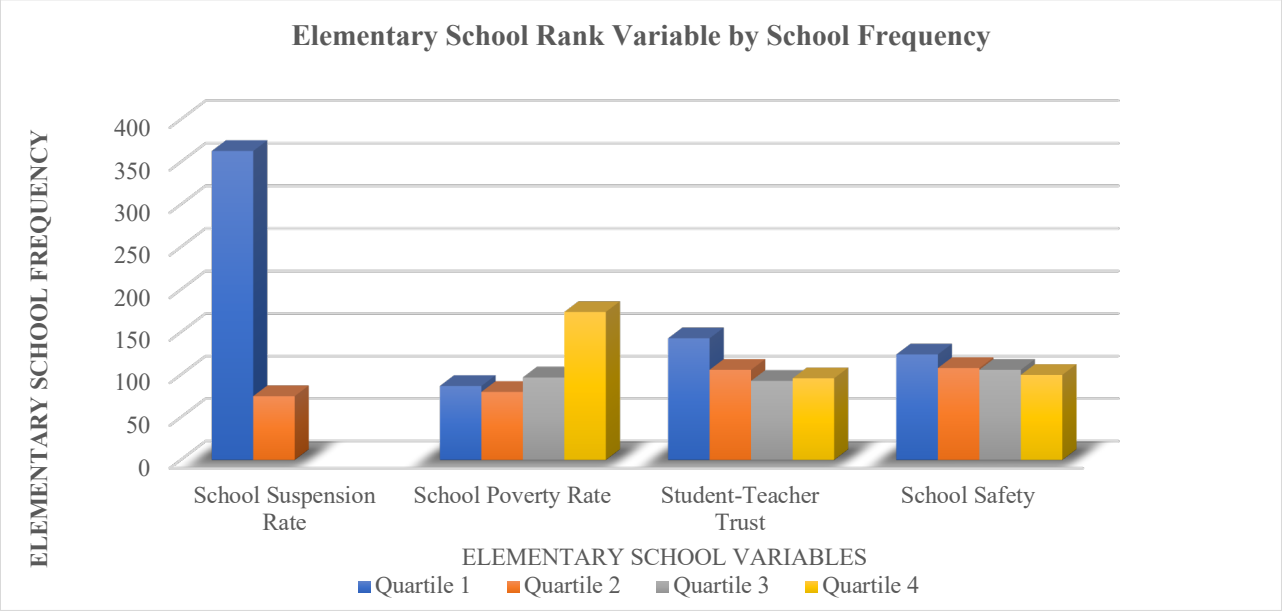
Elementary school-level characteristics most related with the probability of being overage for grade.

The next set of analyses were performed to examine (a) the relation of elementary school-level characteristics on the probability of being overage for grade, and (b) the relation of

elementary school-level and individual-level factors on the probability of being overage for grade. The following school-level factors were included in the model as quartile variables: (a) student perception of school safety, (b) student perception of student–teacher trust, (c) school poverty rate, and (d) school suspension rate was included as a 2-quantile variable. See Figure 4.4 for school level rank variables by elementary school, and Figure 4.5 for school level rank variables by student sample.

Figure 4.4

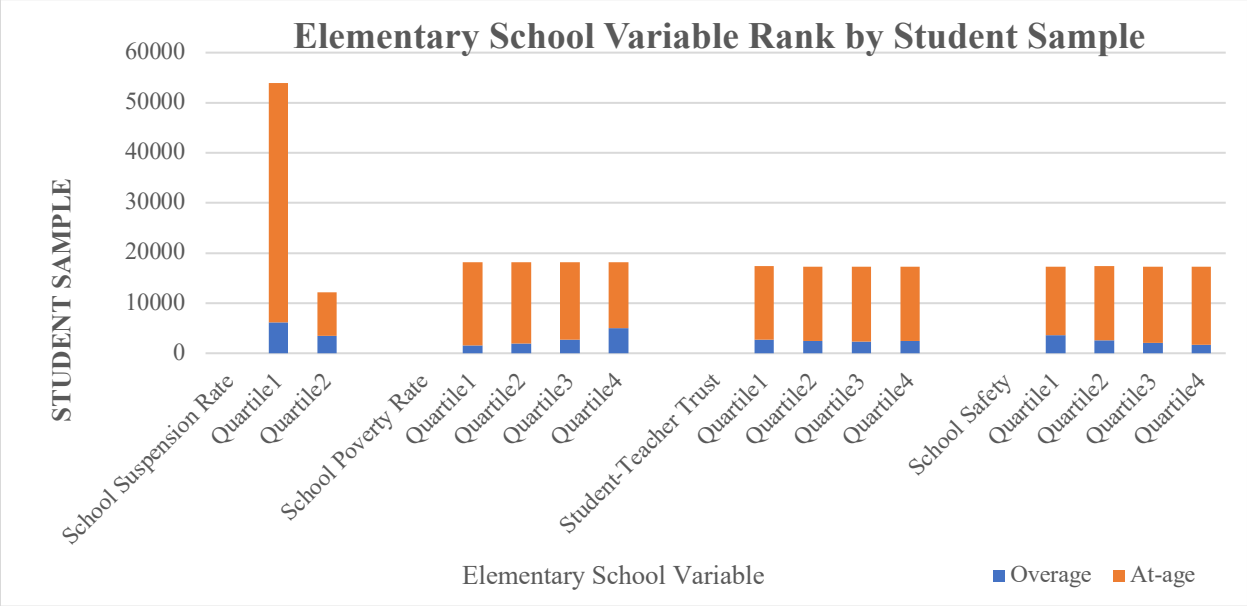
Summary of School Level Variable Rank by Elementary School Frequency



Note. Predictor variables were treated as quartiles based on the entire student sample. See Table 3.1 for explication of quartiles; Quartile 1 (i.e., lowest) to Quartile 4 (i.e., highest).

Figure 4.5

Summary of School Level Variable Rank by Student Sample



Note. Quartiles split the data into 4 even parts based on the entire sample of students (i.e., students in the top quartile of xyz). See Table 3.1 for explication of quartiles; Quartile 1 (i.e., lowest) to Quartile 4 (i.e., highest).

Before proceeding with the multilevel mixed-effects binary logistic regression model, each individual- and school-level variable was examined in isolation of the other variables. When examined individually, each variable was a statistically significant predictor ($p < 0.001$) of students' odds of being overage for grade. Each variable was then checked for strong correlations with other variables in the model. School poverty rate and percentage of staff that identified as BIPOC were highly and positively correlated showing a .75 correlation coefficient. This indicated high poverty schools had high rates of BIPOC staff. The decision to remove BIPOC staff from the model was to ensure there was no multicollinearity, but also so that results would not to be interpreted to suggest that a higher rate of BIPOC staff were associated with greater odds of overage students. Multicollinearity diagnostics were run for the remaining

school-level variables, and the variance inflation factor statistic for each variable is indicated in Table 4.8. The results did not provide any strong indicators of collinearity among remaining school-level variables.

Table 4.8

Summary of Diagnostic Tests for Multicollinearity School-Level Variables

Variable	Variance inflation factor
Suspension rate	1.03
School poverty	1.38
Student perception of school safety	1.70
Student perception of student–teacher trust	1.30

A multilevel mixed-effects binary logistic regression model was estimated with only school-level predictors on the odds of being overage (i.e., Model 1). A likelihood-ratio test was conducted comparing the current model with a random cluster effect at the school level to an ordinary logistic model with no school effects and reports a p value that was effectively zero ($p < 0.001$). This indicated the variance in mean of overage status at the school level was highly significant and the multilevel approach was favored over the ordinary logistic model that did not account for clustering. The intraclass correlation (ICC = 0.08) suggested an appreciable clustering of overage students in elementary school, suggesting 8% of the variation of overage occurred at the school level and might have been attributable to elementary school factors; 18% of the variability was attributable to elementary schools without controlling for school level variables.

A multilevel mixed-effects binary logistic regression model was then estimated with individual-level predictors on the odds of being overage (i.e., Model 2). A likelihood-ratio test

was conducted comparing the current model to a fixed effects model with no school effects and reports a *p* value that was effectively zero ($p < 0.001$). This again indicated the variance in mean of overage status at the school level was highly significant and the multilevel approach was a significant improvement over an ordinary logistic model that did not account for clustering. The intraclass correlation (ICC = 0.05) suggested an appreciable clustering of overage students in elementary school, suggesting 5% of variability in overage was attributable to schools over and above the effects of the covariates in the model.

The results of the multilevel mixed-effects binary logistic regression models are presented in Table 4.9, including adjusted odds ratios (AOR) and 95% confidence intervals (95% CI) of the factors associated with the odds of being overage. Significant results are highlighted in the table.

Table 4.9

Multilevel Mixed-Effects Logistic Regression Models, including Adjusted Odds Ratios

Factors in quartiles	Elementary school factors (Model 1)	Elementary school factors w/ individual level factors (Model 2)
	AOR[e] [95% CI]	*AOR*[e] [95% CI]
Intercept	0.11 [0.06, 0.20]	0.08 [0.01, 0.31]
School suspension rate (ref: schools with 0–1% suspension rate)		
q2: school: with > 1% suspension rate	**2.05 [1.87, 2.24]**	**1.32 [1.19, 1.46]**
School safety (ref: schools with poor school safety between -2 to -4 *SD* below the *M*)		
q2 Fair: .5 to -2 *SD*	0.95 [0.83, 1.08]	0.96 [0.84, 1.09]
q3 Good: .6 to 2.4 *SD*	0.90 [0.78, 1.04]	0.98 [0.84, 1.13]
q4 Great: 2.5 to 4 *SD* above the *M*	**0.75 [0.63, 0.89]**	0.91 [0.77, 1.09]

Table 4.9 Continued

Factors in quartiles	Elementary school factors (Model 1)	Elementary school factors w/ individual level factors (Model 2)
	AOR[e] [95% CI]	*AOR*[e] [95% CI]
Student teacher trust (ref: schools with Poor student–teacher trust between -2 to -4 *SD* below the *M*)		
q2 Fair: .5 to -2 *SD*	0.92 [0.80, 1.06]	0.92 [0.79 1.02]
q3 Good: .6 to 2.4 *SD*	0.95 [0.82, 1.09]	0.90 [0.76, 1.01]
q4 Great: 2.5 to 4 *SD* above the *M*	**0.75 [0.66, 0.89]**	0.77 [0.67, 1.01]
School poverty (ref: schools with lowest level of poverty between -1.7 and -.1 SD below the M)		
q2: schools: between .1 and .2 *SD*	1.20 [0.99, 1.45]	1.08 [0.92, 1.27]
q3: schools: between .2 and 1 *SD*	**1.60 [1.31, 1.94]**	**1.45 [1.23, 1.72]**
q4: schools: between 1 and 2 *SD* above the *M* (highest school poverty)	**3.05 [2.54, 3.67]**	**2.02 [1.69, 2.41]**
NWEA reading percentile (ref: students who scored between 84–99%)		
q2: students who scored between 70–83%		**1.49 [1.28, 1.73]**
q3: students who scored between 52–67%		**2.10 [1.80, 2.45]**
q4: students who scored between 1–50%		**2.84 [2.42, 3.34]**
NWEA math percentile (ref: students who scored between 84-99%)		
q2: students who scored between 70–83%		**1.57 [1.36, 1.82]**
q3: students who scored between 52–67%		**2.25 [1.94, 2.60]**
q4: students who scored between 1–50%		**3.29 [2.81, 3.84]**
Absences (ref: 0–2 absences)		
q2: students with 2.5–5.5 absences		**1.21 [1.08, 1.35]**
q3: students with 6–10.5 absences		**1.30 [1.17, 1.45]**
q4: students with > 11 absences		**1.91 [1.71, 2.14]**
Failed courses (ref: no failed course)		
q2: students with at least 1 failed course		**1.37 [1.25, 1.50]**

Note. Bold denotes $p < 0.05$. *AOR* = adjusted odds ratio, *95% CI* = 95% confidence interval, *Ref* = reference group.

All results discussed next describe the relation of elementary school factors (i.e., Model 1) and elementary school factors with individual level factors neighborhood (i.e., Model 2) on the odds of being overage are from Table 4.9.

School Suspension Rate

School suspension was measured as the percentage of suspensions in each school and was treated as a two-quantile variable in the analyses. The following results show the relation of school suspension rate on the probability of being overage for grade with Quartile 1 as the reference group, representing elementary schools with 0%–1% suspension rates. Students who attended elementary schools with suspension rates higher than 1% had 2.05 times greater odds of being overage (95% CI [1.87, 2.24]), or an overage rate of 18%, compared to students who attended elementary schools with less than 1% suspension rates.

The following results show the relation of school suspension rate on the probability of being overage for grade with individual-level predictors (i.e., Model 2). When accounting for individual-level factors, the odds ratio decreased compared to Model 1; however, school suspension rate remained a significant predictor on the odds of being overage for grade. Students who attended elementary schools with suspension rates higher than 1% had 1.32 times greater odds of being overage (95% CI [1.19, 1.46]), compared to students who attended elementary schools with less than 1% suspension rates. This finding suggested when accounting for individual-level factors, there was an 8% decrease in the overage rate from 18% to 10%, quite a significant rate.

Student Perception of School Safety

School safety was the school average score of student perception of school safety. The following results show the relation of student perception of school safety on the probability of being overage for grade with Quartile 1 as the reference group, representing elementary schools with poor perceptions of school safety. Only elementary schools with the highest score of school safety (i.e., Quartile 4) were significant and associated with lower odds of being overage (q4;

AOR = .75; 95% CI [0.63, 0.89]), compared to elementary schools with the lowest school average safety score. This means students who attended elementary schools with great perceptions of school safety had .75 times lesser odds of being overage at a rate of 8%, compared to students who attended elementary schools with poor perceptions of school safety.

The following results show the relation of student perception of school safety on the probability of being overage for grade with individual-level predictors (i.e., Model 2). Elementary schools with the highest score of school safety (i.e., Quartile 4) were no longer significant in this model. This finding may suggest the effects of school safety on the odds of being overage were mediated by the individual-level factors included in Model 2.

Student Perception of Student–Teacher Trust

Student–teacher trust was the school average score of student perception of student–teacher trust in their elementary school. The following results show the relation of student perception of student–teacher trust on the probability of being overage for grade with Quartile 1 as the reference group, representing elementary schools with poor perceptions of student–teacher trust. Only elementary schools with the highest score of student–teacher trust (i.e., Quartile 4) was significant and associated with lower odds of being overage (q4; AOR = .75; 95% CI [0.66, 0.89]), compared to elementary schools with the lowest average student–teacher trust score. This means students who attended elementary schools with great perceptions of student–teacher trust had .75 times lesser odds of being overage at a rate of 8%, compared to students who attended elementary schools with poor perceptions of student–teacher trust.

The following results show the relation of student perception of student–teacher trust on the probability of being overage for grade with individual-level predictors (i.e., Model 2). Elementary schools with the highest score of student–teacher trust (i.e., Quartile 4) were no

longer significant in this model. This finding may suggest the effects of student–teacher trust on the odds of being overage were mediated by the individual level factors included in Model 2.

School Poverty

School poverty was measured as the level of poverty in each school, estimated as standard deviations above and below the mean (higher is worse). Students who attended elementary schools with the highest percentage of poverty (i.e., Quartile 4) and second highest (i.e., Quartile 3) were at higher odds of being overage (q4; AOR = 3.05; 95% CI [2.54, 3.67]); (q3; AOR = 1.60; 95% CI [1.31, 1.94]), compared to students who attended elementary schools with the lowest level of poverty. Students who attended elementary schools with highest level of poverty, between 1 and 2 standard deviations above the mean, had 3.05 times greater odds of being overage, which is a remarkable overage rate of 25%, compared to students who attended elementary schools with lowest level of poverty.

The following results show the relation of school poverty on the probability of being overage for grade with individual-level predictors (i.e., Model 2). In this model, the odds ratio decreased across quartiles; however, Quartiles 3 and 4 remained significant predictors on the odds of being overage for grade. These findings suggested, despite accounting for education related factors at the individual level, school poverty was associated with higher odds of being overage (q3; AOR = 1.45; 95% CI [1.23, 1.72]; q4; AOR = 2.02; 95% CI [1.69, 2.41]), compared to schools with the lowest level of poverty. The overage rate for elementary schools with the highest school poverty was 14%, an 11% decrease from Model 1, nevertheless, a substantial rate.

Individual-Level Predictors

Model 2 was the multilevel mixed-effects binary logistic regression model estimated with both elementary school- and individual-level predictors on the odds of being overage. The following individual-level variables were included in the model as they were considered prominent factors that could lead to student retention: (a) NWEA reading percentile, (b) NWEA math percentile, (c) absences, and (d) failed courses.

The following results show the relation of these individual level predictors on the probability of being overage for grade, accounting for elementary school factors at Level 2 in the model. The odds ratio results for the individual level factors were very similar to Model 2 in Aim 1b, which accounted for neighborhood factors at Level 2 and individual level factors at Level 1. The reference group for the NWEA math and reading exam were students who scored between 84–99 percentile. For the NWEA reading exam, students in Quartiles 2 (i.e., 70–83 percentile), 3 (i.e., 52–67 percentile), and 4 (i.e., 1–50 percentile) had greater odds of being overage (q2; AOR = 1.49; 95% CI [1.28, 1.73]; q3; AOR = 2.10; 95% CI [1.80, 2.45]; q4; AOR = 2.84; 95% CI [2.81, 3.84]), compared to students in Quartile 1 with the highest percentile. For the NWEA math exam, students in Quartiles 2 (i.e., 70–83 percentile), 3 (i.e., 52–67 percentile), and 4 (i.e., 1–50 percentile) had greater odds of being overage (q2; AOR = 1.57; 95% CI [1.36, 1.82]; q3; AOR = 2.25; 95% CI [1.94, 2.60]; q4; AOR = 3.29; 95% CI [2.81, 3.84]), compared to students in Quartile 1 with the highest percentile.

Student absences were also associated with odds of being overage. The reference group for absences were students with zero to two absences. Students in Quartile 2 (i.e., 2.5–5.5 absences) had 1.21 times greater odds (95% CI [1.08, 1.35]) of being overage at a 10% rate, students in Quartile 3 (i.e., 6–10.5 absences) had 1.30 times greater odds (95% CI [1.17, 1.45])

of being overage at a 9% rate, and students in Quartile 4 (i.e., > 11 absences) had 1.91 times greater odds (95% CI [1.71, 214]) of being overage at a 13% rate, compared to students in Quartile 1 with the lowest absences.

Failing a course in eighth grade was associated with higher odds of being overage. Students with at least one failed course were at 1.51 times greater odds (95% CI [1.43, 1.60]) of being overage at a rate of 11%, compared to students with no failed courses.

Specific Aim 2b Results

The next set of analyses were performed to examine within and between elementary school effects on the probability of being overage for grade as they relate to race and sex. Table 4.10 presents the results of the multilevel mixed-effects binary logistic regression model of the within and between elementary school effects, controlling for all student and neighborhood covariates in the model. Significant results are highlighted in the table.

Table 4.10

Multilevel Mixed-Effects Logistic Regression Models for Between and Within School Effects for Race and Sex

Between school effects for race and sex	*AOR*[e] [95% CI]	Within school effects for race and sex	*AOR*[e] [95% CI]
Sex: male (ref: female)	1.19 [0.84, 1.69]	Sex: male (ref: female)	**1.15 [1.11 1.20]**
Race/ethnicity (ref: white)		Race/ethnicity (ref: white)	
Black/African American	**1.27 [1.05, 1.53]**	Black/African American	**1.18 [1.06, 1.31]**
Latine	1.02 [0.84, 1.24]	Latine	0.95 [0.86, 1.04]
Asian/Pacific Islander	1.11 [0.97, 1.27]	Asian/Pacific Islander	1.02 [0.95, 1.09]

Note. Bold denotes $p < 0.05$. *AOR* = adjusted odds ratio, *95% CI* = 95% confidence interval, *Ref* = reference group.

Results from Table 4.10 show between effects for Black students, suggesting elementary schools with aa high proportion of Black students were related to higher odds of being overage for grade (Black; AOR = 1.27; 95% CI [1.05, 1.53]), compared to elementary schools with high proportion of white students. Results from Table 4.10 also show within effects for Black students, suggesting Black students had higher odds of being overage for grade controlling for the racial composition of the school (AOR = 1.18; 95% CI [1.06, 1.31]). Lastly, significant within effects for males suggest male students relative to female students had higher odds of being overage for grade (AOR = 1.15; 95% CI [1.11, 1.20]).

Summary of Key Findings for Aim 2a and 2b

Several key findings emerged from these analyses:

- Clustering was found at the elementary school level in both models with and without individual predictors, suggesting variability in overage outcome was attributable to elementary schools, and the multilevel approach was favored over the ordinary logistic model that did not account for clustering.
- School poverty, school suspension rate, student perceptions of school safety, and student–teacher trust were all associated with the odds of being overage for grade. Each variable differed on the quartiles that were significant; however, Quartile 4 across variables was associated with greater odds of being overage in comparison to the reference group.
- After accounting for individual-level variables, only school poverty and school suspension rate were significant.
- All individual-level variables in the model were associated with higher odds of being overage for grade compared to the reference group.

- Controlling for racial composition of the school, Black students had higher odds of being overage for grade. More specifically, students at schools with many Black students had a higher risk of being overage, and Black students had a higher risk than students of other races in the same school. Also, male students had a higher risk than female students in the same school.

Specific Aim 2c Results

Because a full cross-classified multilevel mixed-effects binary logistic model simultaneously incorporating school- and neighborhood-level predictors could not be estimated due to its size, the variation of risk of being overage explained by elementary school and neighborhood could only be interpreted without the covariates when accounting for clustering at the school and neighborhood level. The results showed the importance of a cross-classified model and demonstrated the variation of risk of overage explained by elementary school and the variation of risk explained by the neighborhood level.

A two-level multilevel mixed-effects binary logistic regression model was estimated for the odds of being overage, without any predictors and accounting for clustering at the school-level, shown in Table 4.11, Model 1. The table shows a two-level (i.e., students in schools) variance components model. The model was an unconditional one; it included no covariates. The school variance, therefore, summarized the variability in school means and can be interpreted as a measure of school-level characteristics on the odds of being overage for grade. The intercept was 0.19, which represents the odds of the outcome overall. The within school variance was fixed to pi^2/3 in logistic models, and the between school variance was estimated to be 0.54.

Table 4.11

Multilevel and Cross-Classified Multilevel Mixed-Effects Binary Logistic Regression Model With No Covariates

Between variance	Multilevel mixed-effects binary logistic regression model with no covariates accounting for level 2 elementary school effects (Model 1)	Multilevel mixed-effects binary logistic regression model with no covariates accounting for level 2 neighborhood effects (Model 2)	Cross-classified multilevel mixed-effects binary logistic regression model with no covariates accounting for level 2 elementary school effects and level 3 neighborhood effects (Model 3)
Intercept	0.19 [0.17, 0.20]	0.19 [0.18, 0.20]	0.18 [0.17, 0.20]
Between school variance	0.54 [0.51, 0.70]		0.39 [0.36, 0.58]
Between neighborhood variance		0.34 [0.29, 0.39]	0.15 [0.11, 0.16]

Note. The within school and neighborhood variance is fixed to pi^2/3 in logistic models. This is at a 95% confidence interval.

A two-level multilevel mixed-effects binary logistic regression model was estimated for the odds of being overage, without any predictors and accounting for clustering at the neighborhood-level, shown in Table 4.11, Model 2. The table shows a two-level (i.e., students in neighborhoods) variance components model. Like Model 1, this was an unconditional model; it included no covariates. The neighborhood variance, therefore, summarized the variability in neighborhood means and can be interpreted as a measure of neighborhood-level characteristics on the odds of being overage for grade. The intercept was 0.19, which represented the odds of the outcome overall. The between neighborhood variance was estimated to be 0.34.

A cross-classified multilevel mixed-effects binary logistic model was estimated for the odds of being overage, without any predictors, shown in Table 4.11, Model 3. Whereas Model 1

accounted for school effects but ignored neighborhoods, and Model 2 accounted for neighborhood effects but ignored schools, Model 3 simultaneously accounted for both sources of overage variation. Because the data were not a pure hierarchy (i.e., the data were cross-classified), Model 3 was specified as a cross-classified variance components model. The estimate of overage variance, for example, was interpreted as the variability between students having accounted for both school effects and neighborhood effects. The intercept was 0.18, which represented the odds of the outcome overall. The between school variance was estimated to be 0.39 and the between neighborhood variance was estimated to be 0.15.

In summary, between school variance in Model 1 without covariates was 54%. Between neighborhood variance in Model 2 was 34%. In Model 3, when accounting for a three-level cross classified model, the between school variance decreased to 39% and 15% of the variation in overage lied between neighborhoods. A large portion of the variation of risk continued to lie at the school level, which was unsurprising and common in school-based research; however, Model 3 suggested there was still variation that lies at the neighborhood level worth accounting for in the model. Model 3 results demonstrated the importance of simultaneously accounting for both sources of influence on being overage for grade. When excluding one of the classifications, whether it be schools or neighborhoods, the importance of the classification that was included (e.g., schools) were overstated and the importance of the classification not included (e.g., neighborhoods) were understated.

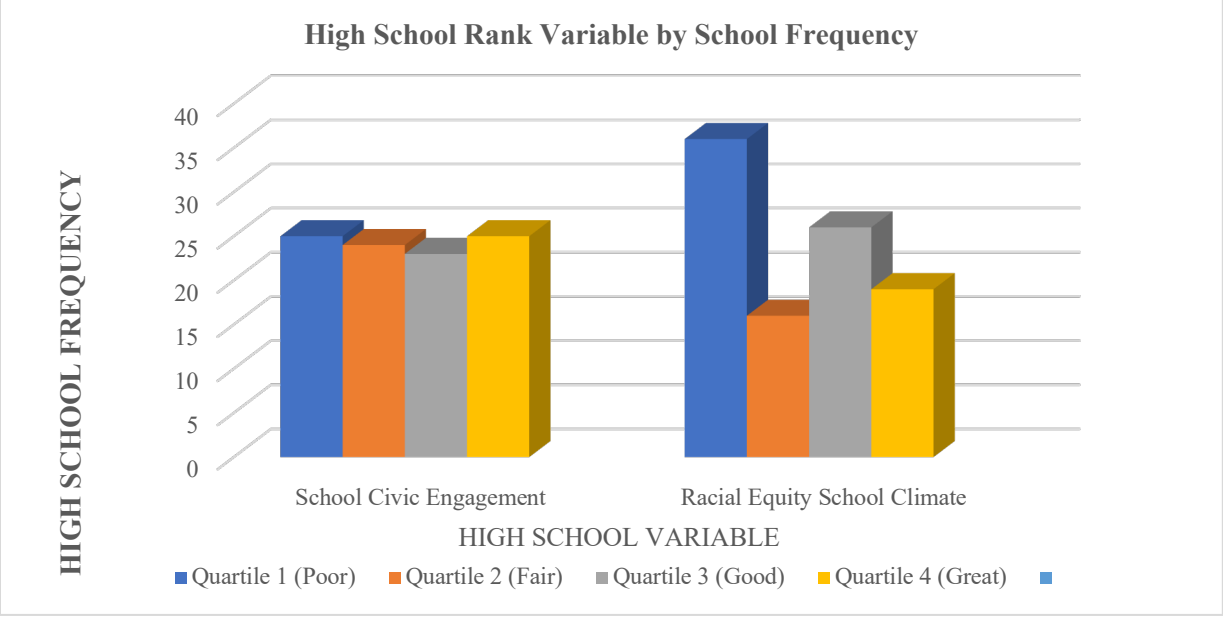
Specific Aim 3a Results

The next set of analyses were performed to examine high school level variables: (a) student perception of racial equity school climate and (b) student perception of school civic engagement as promotive factors of high school completion for overage students. Both high

school variables were treated as quartiles. See Figure 4.6 for school level rank variables by high school and Figure 4.7 for school level rank variables by student sample. Multilevel mixed-effects binary logistic regression model was estimated with only school-level predictors, and then estimated separately including an interaction between racial equity school climate and overage, and an interaction between school civic engagement and overage. In all analyses, the dependent variable was binary (i.e., graduates or nongraduates). Graduates were students who started at CPS high schools and who graduated in 4 years from a CPS high school. Nongraduates were students who started at CPS high schools who left school without a diploma, students who transferred to a different district, and students who were still enrolled in school but had not yet received a high school diploma in 4 years.

Figure 4.6

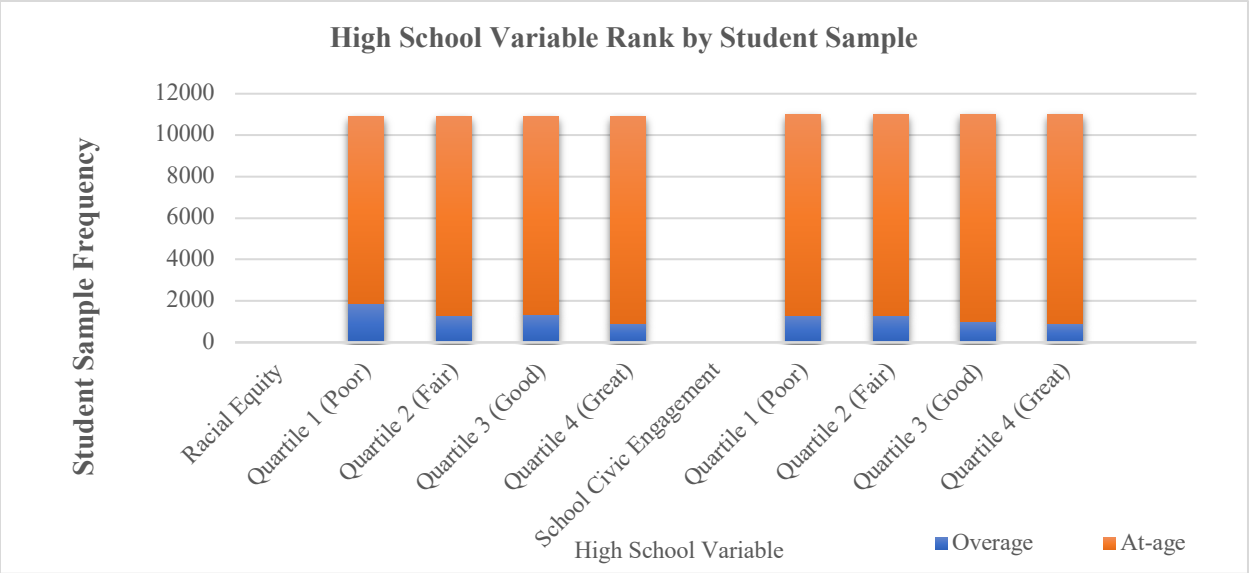
Summary of School Level Variable Rank by High School Frequency



Note. Predictor variables were treated as quartiles based on the entire student sample. See Table 3.1 for explication of quartiles.

Figure 4.7

Summary of School Level Variable Rank by Student Sample



Note. Quartiles split the data into four even parts based on the entire sample of students (i.e., students in the top quartile of xyz). The bar chart shows students who are overage are much less likely to be at high schools with great racial-equity climate or high schools with great school civic engagement.

Before proceeding with the multilevel mixed-effects binary logistic regression model, both school level variables were examined in isolation of each other. When examined individually, each variable was a statistically significant predictor ($p < 0.001$) of students' odds of graduating. Each variable was then checked for strong correlations with other variables in the model. There was no strong correlation in the model. Multicollinearity diagnostics were run for both school level variables, and the variance inflation factor statistic for each variable is indicated in Table 4.12. The results did not provide any strong indicators of collinearity among high school level variables.

Table 4.12

Summary of Diagnostic Tests for Multicollinearity High School-Level Variables

Variable	Variance inflation factor
Student perception racial equity school climate	1.11
Student perception of school civic engagement	1.11

A multilevel mixed-effects binary logistic regression model was estimated with only school-level predictors on the odds of graduation for all students (i.e., Model 1). A likelihood-ratio test was conducted comparing the current model with a random cluster effect at the school level to an ordinary logistic model with no school effects and reported a p value that was effectively zero ($p < 0.001$). This indicated the variance in mean of graduation status at the school level was highly significant and the multilevel approach was favored over the ordinary logistic model that did not account for clustering. The intraclass correlation (ICC = 0.26) for Model 1 suggested 26% of variability in graduation outcome was attributable to high schools; 36% of the variability was attributable to high schools without controlling for school level variables.

Multilevel mixed-effects binary logistic regression models were then estimated separately with an interaction between racial equity school climate and overage (i.e., Model 2) and an interaction between school civic engagement and overage (i.e., Model 3). Likelihood-ratio tests were conducted comparing the current models to fixed effects models with no school effects and report p values that were effectively zero ($p < 0.001$). This again indicated the variance in mean of graduation status at the school level was highly significant and the multilevel approach was a significant improvement over an ordinary logistic model that did not account for clustering. The intraclass correlation (ICC = 0.25) for Models 2 and 3 suggested 25% of variability in graduation

outcome was attributable to high schools. Table 4.13 displays all results of the multilevel mixed-effects binary logistic regression models, including adjusted odds ratios (AOR) and 95% confidence intervals (95% CI) of the factors associated with the odds of graduating high school in 4 years. Significant results are highlighted in the table.

Table 4.13

Multilevel Mixed-Effects Logistic Regression Models

Factors in quartiles	Graduation rates for subgroups (unmodeled)	Effects for REC and CIV on all students (Model 1)	Two-way interaction effects REC (Model 2)	Two-way interaction effects CIV (Model 3)
		AOR[e] [95% CI]	*AOR*[e] [95% CI]	*AOR*[e] [95% CI]
Overage	**0.50 [0.41, 0.59]**		**0.21 [0.19, 0.31]**	**0.22 [0.19, 0.31]**
[intercept]	**2.16 [1.98, 2.43]**	2.46 [2.10, 2.55]	**2.18 [2.10, 2.28]**	**2.38 [2.01, 3.06]**
Racial equity climate (ref: schools with poor REC between 1 to 2.5 *SD* above the *M*)				
q2 Fair: 1 to 1.5 *SD*		1.32 [1.06, 1.64]	1.01 [0.95, 1.17]	
q3 Good: -1 to -2 *SD*		1.93 [1.24, 2.13]	1.09 [0.95, 1.20]	
q4 Great: -2 to -4 *SD* below the *M*		**2.38 [2.23, 3.12]**	**1.18 [1.10, 1.24]**	
School civic engagement (ref: schools with poor CIV between -1 to -2 *SD* below the *M*)				
q2 Fair: -.1 to 1 *SD*		0.96 [0.89, 1.23]		0.96 [0.89, 1.01]
q3 Good: 1 to 2 *SD*		1.43 [1.35, 1.86]		1.00 [0.90, 1.07]
q4 Great: 2 to 4 *SD* above the *M*		**2.46 [1.41, 2.55]**		1.08 [0.92, 1.12]
REC x overage (ref: schools with poor REC between 1 to 2.5 *SD* above the *M*)				
q2 Fair: 1 to 1.5 SD			0.90 [0.96, 1.24]	
q3 Good: -1 to -2 SD			1.01 [0.96, 1.26]	
q4 Great: -2 to -4 SD below the M			**1.12 [1.10, 1.37]**	
SCE x overage (ref: schools with poor CIV between -1 to -2 *SD* below the *M*)				
q2 Fair: -.1 to 1 SD				0.97 [0.85, 1.11]
q3 Good: 1 to 2 SD				1.13 [0.93, 1.17]
q4 Great: 2 to 4 SD above the M				1.21 [0.97, 1.29]

Note. Bold denotes $p < 0.05$. *AOR* = adjusted odds ratio, *95% CI* = 95% confidence interval, *Ref* = reference group.

The following results from the first column (unmodeled) in Table 4.13 describe the odds of graduating in 4 years for subgroups, overage and at-age, without accounting for racial equity climate and school civic engagement. At-age students had 2.16 times greater odds of graduating (95% CI [1.98, 2.43]), compared to overage students. This was a 4-year graduation rate of 68%. Overage students had .5 times less odds of graduating in 4 years (95% CI [0.41, 0.59]) with a graduation rate of 52%, compared to at-age students.

The following results show the relation of student perception of racial equity climate and school civic engagement on the probability of graduation for all students (i.e., Model 1), and interaction effects of racial equity climate for overage students (i.e., Model 2), and interaction effects of civic engagement for overage students (i.e., Model 3) from Table 4.13.

Racial Equity Climate

Racial equity climate was measured as the school average score of students' perception of racial equity climate in their high school; lower scores indicated positive racial equity school climate. The following results show the relation of student perception of racial equity climate on the probability of graduation for all students with Quartile 1 as the reference group, representing high schools with a racial equity climate rated as poor. Students who attended high schools with a racial equity climate rated as great had 2.38 times greater odds of graduating high school in 4 years (95% CI [2.23, 3.12]), or a graduation rate of 85%, compared to students who attended high schools with poor racial equity climate.

The following results account for interaction effects and show the relation of student perception of racial equity climate on the probability of graduation for overage students (i.e., Model 2). Overage students who attended high schools with great racial equity climate showed an interaction effect of 1.12 (95% CI [1.10, 1.37]) times 1.18 (95% CI [1.10, 1.24]), indicating

that odds are higher by 1.32 relative to students who were overage at schools where the racial equity climate is poor. This means that overage students who attended high schools with great racial equity climate had 1.32 times higher odds of graduating high school in 4 years, or a graduation rate of 74%, compared to overage students who attended high schools with poor racial equity climate. To put this in perspective, overage students who were in the reference group, representing high schools with poor racial equity climate, were associated with .46 times lesser odds of graduating high school in 4 years; interaction effect of .21 (95% CI [0.19, 0.31]) times 2.18 (95% CI [2.10, 2.38]), or a graduation rate of 31% (see Table 4.14).

Table 4.14

Graduation Rates for Two-Way Interaction Effects for Racial Equity Climate in Relation to Reference Group Poor

Racial equity climate	Graduation rates overage (%)	Graduation rates at-age (%)
Unmodeled (without REC)	52	68
*Ref, Poor REC	31	68.5
Fair REC	66	69
Good REC	70	70
Great REC	**74**	**72**

Note. Bold denotes $p < 0.05$, *Ref* = reference group.

At-age students who attended high schools with great Racial Equity Climate had an interaction effect of 1.18 (95% CI [1.10, 1.24]) times 2.18 (95% CI [2.10, 2.38]), indicating odds of 2.6. This means that at-age students who attended high schools with great racial equity climate had 2.6 times greater odds of graduating high school in 4 years, or a graduation rate of 72%, compared to at-age students who attended high schools with poor racial equity climate.

Similarly, the intercept in this model suggested at-age students who were in the reference group, representing high schools with poor racial equity climate, were associated with 2.18 times odds (95% CI [2.10, 2.38]) of graduating high school in 4 years, which was a graduation rate of 68.5% (see Table 4.14).

School Civic Engagement

School civic engagement was the average school score of students' perception of school civic engagement in their high school. The following results show the relation of student perception of school civic engagement on the probability of graduation for all students (i.e., Model 1; see Table 4.13) with Quartile 1 as the reference group, representing high schools with school civic engagement rated as poor. Students who attended high schools with great school civic engagement had 2.46 times greater odds of graduating high school in 4 years (95% CI [1.41, 2.55]), or a graduation rate of 86%, compared to students who attended high schools with poor school civic engagement. As indicated in Model 3 (see Table 4.13), there were no significant interaction effects for school civic engagement and overage students.

Specific Aim 3b Results

The next set of analyses were performed to see if racial equity climate and school civic engagement reduced the difference in graduation rates for overage students compared to students at-grade level differentially based on race and sex. Four multilevel mixed-effects binary logistic regression models were estimated including Model 1: two-way and three-way interactions between racial equity school climate, overage, and race; Model 2: two-way and three-way interactions between school civic engagement, overage, and race; Model 3: two-way and three-way interactions between racial equity school climate, overage, and sex; and Model 4: two-way and three-way interactions between school civic engagement, overage, and sex. Likelihood-ratio

tests were conducted for all four models comparing the current models to fixed effects models with no school effects and reported p values that were effectively zero ($p < 0.001$). This indicated the variance in mean of graduation status at the school level was highly significant and the multilevel approach was a significant improvement over an ordinary logistic model that did not account for clustering. In all four models, there were no significant two-way or three-way interaction effects for race or sex.

Summary of Key Findings for Aim 3

Several key findings emerged from these analyses:

- Clustering was found at the high school level suggesting variability in graduation outcome was attributable to high schools, and the multilevel approach was favored over the ordinary logistic model that did not account for clustering.
- Students who attended schools with great school civic engagement and great racial equity climate had higher odds of graduating, compared to students who attended schools with poor school civic engagement and poor racial equity climate.
- Overage students who attended schools with great racial equity climate had greater odds of graduating compared to students who attended schools with poor racial equity climate.
- There were no significant interaction effects for race and sex.

Chapter 5: Discussion Section

Understanding factors related to students who become overage for grade can be misunderstood if researchers, educators, and policy makers only focus on individual student characteristics and do not consider the structural conditions of schools and neighborhoods that may impact their outcomes. The lived experiences of students who are disproportionally impacted are shaped by the structural conditions of schools and neighborhoods, including structural racism, resulting in circumstances such as living in racially segregated neighborhoods. These racially segregated neighborhoods are often characterized by a long history of disinvestment (Metzger et al., 2015). The intent of the present study was to examine factors that underscore structural disinvestments/lack of investment and opportunities related to students overage for grade, and high school level characteristics that may promote high school completion for overage students.

The aims of this study were threefold. Aim 1 focused on context of place by examining the distribution of ninth grade CPS overage students across Chicago neighborhoods, bounded by census tracts, and the extent in which risk of grade retention is defined by the neighborhood in which students live. Given that inequity among school districts may reinforce macro conditions as it creates concentration of high poverty schools that have been found to be associated with punitive discipline and poor school climate, Aim 2 focused on elementary school level characteristics most related to the probability of being overage for grade. Aim 3 focused on high schools that may support students who begin high school as overage for grade by examining school climate characteristics that may promote high school completion for overage students. The next sections put the findings of each aim in the context of extant literature.

Aim 1: Neighborhood

Neighborhood effects research has established that neighborhoods play a key role in shaping a range of socioemotional, behavioral, and academic outcomes for young people (Gorman-Smith et al., 1999; Hughey et al., 2016; Kelleher et al., 2018; Massey, 1990; Rothstein, 2017; Sampson et al., 2008; Sharkey, 2013; Wolf et al., 2017). The emerging consensus that neighborhoods play a key role in shaping young peoples' outcomes raises a relevant question: which neighborhoods have the best and worst structural opportunities and disinvestment for young people? In particular, the findings from the analyses addressing Aim 1b provide insight on neighborhood level structures of opportunity and lack of investments/divestment as the structures relate to students overage for grade and opportunities for intervention at the systemic level. First, clustering was found at the neighborhood level suggesting variability in overage outcome is, in part, related to neighborhoods. This means neighborhoods, in general, matter. The multilevel analytical approach accounting for clustering recognizes that students residing in particular neighborhoods may share similar characteristics and shared risk for becoming overage for grade. Failure to account for the contextual effects of students' neighborhoods can produce biased risk estimates. This study sought not to produce biased risk estimates by accounting for contextual effects.

Given that students who live in particular neighborhoods may have shared risk for becoming overage for grade, findings from Aim 1b provided several key insights on which neighborhood characteristics, at the census tract level, are associated with the highest odds of being overage for grade. For example, neighborhood variables, including home ownership, unaffordable housing, neighborhood poverty, and access to green space were all associated with higher odds of being overage for grade. To put the study findings in the context of the guiding

transformative racial equity conceptual framework (TREF), neighborhoods lie at the organization level, or third layer, which is defined as sites of material and resource distribution shaped by governance (i.e., second layer) and defined by societal ideologies (i.e., outer layer) that shape life outcomes for young people (The Transdisciplinary Resistance Collective for Research and Policy et al., 2020). Organizations (i.e., neighborhoods, schools) are racial structures that legitimize the unequal distribution of resources and reproduce the racial hierarchies that exist between one another (e.g., high burden racially segregated neighborhoods are disadvantaged and under-resourced relative to high resourced neighborhoods). This racialized process through policy/governance influences which neighborhoods are divested from and are characterized by structural inequities such as limited access to affordable housing, food access zones, stable housing, and quality educational resources. The TREF provided a framework to examine prominent neighborhood characteristics that have been established in neighborhood effects research and their association with the odds of being overage through the lens of neighborhood structural opportunities and disinvestment. The study findings suggested neighborhoods with high rates of unaffordable housing, poverty rate, low rates of homeownership, and limited access to green space are characterized by educational inequities such as the overrepresentation of Black and Latine overage students.

Each neighborhood variable was examined as a quantile variable to show that the associations between neighborhood level factors and the odds of being overage for grade differed at different points in the variable distribution. Examining the variables in this manner can allow policy makers to target interventions to improve neighborhood level structures of opportunity more effectively. Chetty et al. (2018), for instance, examined children's outcomes in adulthood by census tract using longitudinal data across the United States. They found neighborhood

characteristics mattered most at a hyperlocal level when examining upward mobility and other life outcomes. This suggested that a young person's immediate surroundings, particularly within about a half a mile, drive almost all of the association between youth outcomes and neighborhood characteristics. For example, Chetty et al. found traditional proxies for neighborhood disadvantage (e.g., poverty rate) captured more variation when examined at the hyperlocal level. Their coefficient on poverty rates in the child's own census tract was -0.32 and remained statistically significant only until about 0.6 miles away. Poverty rates in the young person's tract mattered 2.7 times more than those in surrounding tracts for upward mobility. Chetty et al. recommended policy makers use this level of census data to better design community redevelopment programs, expand affordable housing, and create programs to improve economic opportunities for young people who grow up in high burden neighborhoods.

This study showed similar results that neighborhood characteristics matter most at a hyperlocal level. Each neighborhood variable examined differed on the quantiles that were significant. These findings helped identify at which point in the distribution the effects of the neighborhood variable remained statistically significant. One major finding to note is that Quartile 4, which consisted of census tracts with the worst category in the distribution (e.g., highest percentage of poverty and lowest percentage of homeowners), across all neighborhood variables was associated with greater odds of being overage in comparison to the reference group that had the highest positive category in the distribution. The reference group for poverty rate, for instance, represented census tracts with the lowest poverty rate between -2.7 and -.2 standard deviations below the mean. Findings suggested that students who lived in census tracts with greater than 2 standard deviations above the mean had the greatest odds of being overage for

grade compared to students who lived in census tracts with the lowest poverty rate, despite accounting for individual-level factors.

One of the fundamental structures of unequal opportunity in high burden neighborhoods is access to affordable, stable, and secure housing. Whelan (2017) noted that despite the largely positive impact of housing identified in extant literature, it is the case that the measured impact of secure housing or homeownership is reduced or in some cases eliminated when additional control variables related to neighborhood disadvantage are incorporated in the analysis. Examining both unaffordable housing and homeownership as quantile variables in this study provide insights on their impact on the odds of being overage for grade, but also on the differing points in the distribution, which provides insight on where policy makers can most effectively leverage federal or state funds. The reference group for unaffordable housing, for instance, represented census tracts with 11%–38% of households paying more than 30% of their income on housing. Findings suggested that students who lived in census tracts with anything above 38% of households paying more than 30% of their income on housing had higher odds of being overage than students who lived in census tracts with less than 38% of households paying more than 30% of their income on housing. Once individual-level factors were accounted for, findings suggested census tracts with anything above 45% of households paying more than 30% of their income on housing had higher rates of overage students than census tracts with less than 38% of households. Students who lived in census tracts with greater than 51% of households paying more than 30% of their income on housing had the greatest odds of being overage for grade compared to students who lived in census tracts with the lowest percentage of unaffordable housing, despite accounting for individual-level factors.

The same pattern was found for home ownership. The reference group of home ownership represented census tracts with 60%–99% of homeowners. Findings suggested that students who lived in census tracts with anything less than 60% of homeowners had higher rates of overage students than census tracts with 60%–99% homeowners. Once accounting for individual-level factors, findings suggested census tracts with less than 45% of homeowners had higher rates of overage students than census tracts with the highest percentage of homeowners. Students who lived in census tracts with anything less than 32% of homeowners had the greatest odds of being overage for grade compared to students who lived in census tracts with the highest percentage of homeowners, despite accounting for individual-level factors. It has been established that individual factors relate to whether a student is retained in grade, but this study's findings suggested, despite these factors being controlled for, homeownership and affordable housing matter particularly. Specifically, students who live in census tracts with greater than 51% of households paying more than 30% of their income on housing and students who live in census tracts with less than 32% of homeowners are more likely to be overage for grade.

The study findings supported extant literature that found an association between affordable housing and homeownership and academic achievement (Ghimire, 2021; Newman & Holupka, 2016). For example, Newman and Holupka (2016) examined the effects of housing affordability burdens above the 30% standard on children's cognitive achievement and found that the effect of the burden was highly associated with children's math ability and their reading comprehension necessary for academic success. Using neighborhood-level data, Ghimire (2021) investigated the impact of neighborhood homeownership rates on students' achievement in Georgia. The findings suggested that a 1-percentage-point increase in homeownership rate at the census tract level increased the percentage of proficient learners and above in third grade reading

by 0.24 percentage points. Furthermore, Ghimire found larger effects of homeownership in low-income, less affluent, or predominantly Black neighborhoods, compared with the overall sample.

Although affordable housing and homeownership are important indicators of neighborhood stability and academic success (Ghimire, 2021; Ghimire & Topple, 2020), the direct mechanism of neighborhood-level homeownership and affordable housing on students' achievement is less known. Several potential direct and indirect mechanisms are hypothesized to explain the relation between affordable housing or homeownership and students' achievement. Stable housing conditions and the stability of neighborhood tenure, wealth or equity that accrues to ownership, and enhanced physical environment are examples of such positive effects associated with affordable housing and homeownership (Whelan, 2017). Neighborhood tenure, for instance, is associated with having larger social networks, which could advance young people's learning and personal development (Ghimire, 2021). Neighborhoods with higher homeownership rates generally have a higher level of civic engagement, political participation, or community involvement (Ghimire, 2021; A. B. Hall & Yoder, 2019). Homeowners are believed to add to the social capital in their neighborhood by engaging in formal and informal civic activities. All of these benefits could serve as a potential mechanism in supporting students' school-related outcomes given that access to safe, stable, and secure housing are fundamental structures of opportunity associated with positive education outcomes (Ghimire, 2021; Kelleher et al., 2018; Whelan, 2017), and would be worthwhile to examine in future research.

Furthermore, most students who are overage for grade could not fulfill the requirements for promotion, such as passing state tests, sufficient attendance and grades, and then not passing summer school. Possible mechanisms that link neighborhood factors to school outcomes may include the burden of unstable housing and lack of financial resources that can be all-consuming

and over-ride other pressing concerns for families. It can prevent families from being able to provide the resources needed to fully navigate the demands of schools and school policies, such as ensuring students get to school every day or can enroll in and pass summer school. Housing instability or economic challenges can make it extremely challenging for students and their families to meet these requirements. Because findings showed that neighborhood factors are related to being overage for grade above and beyond achievement, this suggested a need for targeted supports to ensure all families can navigate the promotion policies equally. For instance, schools have to ensure that students in families with few resources can get to summer school and back and have a safe place to go after school hours when parents are at work.

Moreover, elements of the built environment (e.g., parks and green space) or other aspects of the environment (e.g., access to supermarkets) have been associated with positive socioemotional and behavioral health known to foster positive academic performance (Hughey et al., 2016; R. J. Jackson et al., 2013). Limited access to supermarkets and greenspace have been associated with structural neighborhood disinvestment and variability across neighborhoods have been documented (Harris et al., 2015; Vaughan et al., 2013). This study's findings suggested that students who lived in census tracts with less than 66% access to green space had higher odds of being overage than students who lived in census tracts with 72%–93% access to green space, despite accounting for individual-level factors. Furthermore, students who lived in census tracts with anything less than 59% of green space had the greatest odds of being overage for grade compared to students who lived in census tracts with the highest percentage of green space. Access to supermarket, described as the percentage of households without a car located further than a half-mile from the nearest supermarket, was not a strong explanatory variable in this study.

The study findings supported extant literature that demonstrated an association between education outcomes and green space (Browning & Rigolon, 2019). Census tracts with limited access to green space are associated with higher odds of being overage compared to census tracts with the highest percentage of green space. There are a few hypothesized mechanisms underlying the association between green space and academic outcomes. Natural environments, including green space and tree cover, have been documented to have a stress-reducing effect on young people and positively impact creative play behavior, decrease feelings of anxiety, increase attention, and promote emotional well-being all of which foster academic success (Browning & Rigolon, 2019; Cole et al., 2019). Matsuoka (2010) found the amount of visible green space from student windows at school was positively associated with improved test scores and graduation rates, and A. F. Taylor et al. (2001) found children 7 to 12 years old diagnosed with attention deficit disorder functioned more effectively as their symptoms decreased when exposed to green space. Thus, the present study findings suggested that neighborhoods and school districts with high rates of overage students can directly or indirectly improve student academic outcomes by increasing access to green space.

Aim 1c: Between and Within Neighborhood Effects for Race and Sex

Controlling for racial composition of the neighborhood, Black students had higher odds of being overage for grade, and male students relative to female students had higher odds of being overage for grade, despite controlling for individual-level and neighborhood-level covariates. These study findings raised particular questions about sex and racial bias given the persistence of sex, racial, and ethnic disparities in grade retention that have been documented in extant research (Greene & Winters, 2009; Warren et al., 2014). Data from the Current Population Survey from 1995 to 2010 pointed to sex and racial disparities in grade retention rates, with

Black students retained at almost twice the rate of white students, and male students more likely to be retained at each grade level, even after controlling for academic factors and other individual background characteristics (Warren et al., 2014). Peguero et al. (2021) examined the relation between retention rates, school strictness, and racial/ethnic disparities in urban, rural, and suburban contexts. They found Black and Latine students continued to be at heightened risk for grade retention regardless of whether their school was located in an urban, rural, or suburban community, or in a predominantly white community. They argued their findings demonstrated that racial inequity is not only found in any given community but is rooted in the systemic nature of deeply engrained racial inequity. The present study's findings may support this argument given that it found racial disparities in retention rates across Chicago neighborhoods even after controlling for academic and neighborhood characteristics. Given what is known about the disproportionate rate of Black and male students who are overage for grade across the country, and that neighborhood and individual level factors were controlled for in this particular study, these study findings warrant concern for further examination in future studies.

Aim 2: Elementary School Level Characteristics

The Committee on Developing Indicators of Educational Equity was formed in 2019 to address educational equity and to identify key indicators of equitable access to resources and opportunities in the K–12 education system (National Academies of Sciences, Engineering, and Medicine [NASEM], 2019). The indicators identified include the structural aspects of school systems that may impact opportunity and amplify existing disparities in neighborhood contexts and contribute to unequal outcomes for students. Some of these indicators include concentration of poverty in schools, disparities in suspension rates, perceptions of safety and student–teacher trust, and disparities in curricular breadth such as civic engagement (NASEM, 2019). Drawing

from the framework developed by the Committee on Developing Indicators of Educational Equity and the Transformative Racial Equity Framework, the following elementary school-level factors were examined in relation to overage for grade: (a) school suspension rate, (b) school poverty rate, (c) student perception of student–teacher trust, and (d) student perception of school safety.

Clustering was found at the school level suggesting that variability in overage outcome is attributable to school-level characteristics. This means that elementary schools, in general, matter. This statistical approach recognizes that students attending particular elementary schools may share similar characteristics and shared risk for becoming overage for grade. The emerging consensus that schools play a key role in shaping young people's outcomes raises the question: which schools provide the best and worst opportunities for students overage for grade? Given that students who attend particular elementary schools may have shared risk for becoming overage for grade, findings from Aim 2 provided several key insights on which elementary school level characteristics are associated with the highest odds of being overage for grade. Results of these analyses suggested school level variables, including school poverty rate, school suspension rate, student perception of school safety, and student perception of student–teacher trust were all associated with higher odds of being overage for grade.

To put the study findings in the context of the TREF framework, schools—like neighborhoods in Aim 1—lie at the organizational level, or third layer. Schools are also racial structures that legitimize the unequal distribution of resources and reproduce the racial hierarchies that exist between organizations (e.g., racially segregated schools are disadvantaged and underresourced relative to majority white or diverse schools; Ray, 2019). This racialized process influences which schools are divested from, shut down, and are characterized by high

poverty and educational inequities such as the overrepresentation of Black and Latine students facing high suspensions, absences, and failing test scores. The TREF provided a framework to examine school level assets and structural disinvestment and their association with the odds of being overage. The study findings suggested elementary schools with high rates of school poverty and school suspensions are associated with educational inequities such as the overrepresentation of Black and Latine overage students. Further, study findings suggested elementary schools with great perceptions of school safety and great perceptions of student–teacher trust were associated with lower odds of being overage compared to elementary schools with poor perceptions of school safety or poor perceptions of student–teacher trust. After controlling for individual-level variables, however, neither perceptions of school safety nor student–teacher trust were significant. These findings may suggest the effects of student–teacher trust or perceptions of school safety on the odds of being overage may be mediated by student academic factors included in the model, such as student absences and failed courses.

Given that wealthy neighborhoods tend to have a more stable funding mechanism to finance local schools (e.g., school-based fundraising, local property tax), it is not surprising that elementary schools with highest school poverty rates were associated with higher odds of overage students compared to elementary schools with lowest school poverty rates. In particular, the reference group of lowest school poverty rate represented elementary schools between -1.7 and -.1 standard deviations below the mean. Findings suggested students who attended elementary schools with school poverty rates between .2 and 2 standard deviations above the mean had higher odds of being overage than students who attended elementary schools with the lowest school poverty rate, despite accounting for individual-level factors. However, students who attended elementary schools with school poverty rates between 1 and 2 standard deviations

above the mean had strikingly greater odds of being overage for grade compared to students who attended elementary schools with the lowest school poverty rate, despite accounting for individual-level factors. Although individual factors relate to whether a student is retained in grade, these study findings suggested that despite these factors being controlled for, school poverty matters particularly.

These findings corroborated extant literature that demonstrated high poverty schools generally have higher rates of educational challenges, including high retention rates (Alexander et al., 2003; R. J. Skiba et al., 2004). This is of particular concern for Chicago Public Schools given that the highest concentration of overage students are located on the west and south sides of Chicago, home to predominantly Black and Latine young people, and are associated with high poverty elementary schools. This sheds insight on a systemic mechanism of racial inequity that can only be effectively disrupted through systemic policy change that allocates targeted funds and resources to high poverty schools to deliberately support student success and particularly those deemed high risk for grade retention.

Furthermore, findings suggested students who attended elementary schools with suspension rates higher than 1% had greater odds of being overage compared to students who attended elementary schools with less than 1% suspension rates, despite accounting for individual-level factors. Although individual factors that hold significant value in determining whether a student gets held back matter, this study's findings suggested that despite these things being controlled for, school suspension rates mattered particularly for overage students. These findings corroborated extant literature that demonstrated schools with high discipline rates generally have higher rates of educational challenges, including high grade retention rates, poor test scores and grades, and high school noncompletion (C. Kim et al., 2012; Shedd, 2015). By

design, punitive policies exclude students from the classroom and limit their opportunities to obtain necessary classroom instruction, which raises particular concern for students who are overage or at risk of grade retention.

Aim 2c: Between and Within School Effects for Race and Sex

Controlling for racial composition of the school, the present study found Black students have higher odds of being overage for grade. More specifically, students at schools with many Black students had a higher risk of being overage, and also, in the same school, Black students had a higher risk than students of other races when controlling for school level and individual level characteristics. Furthermore, male students had a higher risk of being overage than female students in the same school. These study findings raised particular questions about sex and racial bias given that grade retention and punitive discipline disproportionately impacted males and Black students, raising particular concern for Black male students (Barnes & Motz, 2018; P. Carter et al., 2017). These findings corroborated extant studies that examined racial disparities in school discipline and retention rates (Peguero et al., 2021; Welsh & Little, 2018). For example, Peguero et al. (2021) found regardless of the disciplinary practices of any particular school located across urban, rural, or suburban communities, Black and Latine students continue to be at heightened risk for grade retention and school punishment.

Research has shown schools that move away from punitive approaches and use restorative justice practice to respond to student discipline challenges see promising outcomes, including lower grade retention rates, strengthened intra-school relationships, improved school climate, and higher academic achievement (Gardella, 2015; Glenn et al., 2021). Although the use of restorative justice techniques have often resulted in better outcomes, existing literature has found disparities in the schools that use these techniques. Payne and Welche (2015) examined a

national random sample to examine which schools are more or less likely to use restorative justice practice, and their influence on racial disparities in discipline. They found schools that implement restorative practice are less likely to have racial disparities in their discipline outcomes compared to schools who do not use restorative practice; yet, schools with proportionally more Black students were less likely to use such techniques when responding to student behavior.

Grade retention and disciplinary action are commonly found clustered together in districts with greater school poverty rates (Shores et al., 2020). High poverty schools are part of a larger racialized system that generates a high rate of disciplinary referrals and commonly rely on school punitive measures such as suspensions or expulsions. These punitive measures further harm Black and Latine students (Annamma, 2017; Barnes & Motz, 2018; P. Carter et al., 2017). Schools cannot control the poverty level of the students they serve. They can, however, control discipline practices and how suspensions and other practices are used. It will be imperative to identify Chicago Public elementary schools with high suspension rates and be intentional on implementing restorative practices to effectively disrupt possible inequitable mechanisms for students at risk for grade retention, particularly for Black and Latine students.

Aim 3: High School Level Characteristics

The elementary school factors examined were related to a greater chance of being overage, and the high school factors examined the extent to which school practices currently make a difference on overage students once they transition to high school. Positive school climate and disparities in curricular breadth such as civic engagement are indicators identified by the Committee on Developing Indicators of Educational Equity that influence opportunities and academic success for students (NASEM, 2019). Drawing from the framework developed by the

Committee on Developing Indicators of Educational Equity and the Transformative Racial Equity Framework, the following high school climate factors (a) student perception of racial equity school climate and (b) student perception of school civic engagement were examined on the odds of overage students graduating high school with a CPS diploma in 4 years.

Racial Equity Climate on the Odds of Graduation for Overage Students

The construct of racial equity school climate in this study was measured by the Racial Equity Climate Scale and represented the extent to which CPS students perceived their school as racially equitable on decisions about discipline at the school, adult's expectations for students at the school, access to advanced courses, and the overall quality of education that students receive in CPS. Weak or poor perceptions of racial equity school climate indicated that students perceive race as a driving influence on these decisions at school. The present study findings showed students who attended high schools with a racial equity climate (REC) rated as great had greater odds of graduating high school in 4 years compared with students who attended high schools with poor REC. Furthermore, overage students who attended high schools with great REC had greater odds of graduating high school in 4 years compared to overage students who attended high schools with poor REC. These study findings suggested that schools with great REC are associated with stronger graduation rates for all students and is especially important for students who are overage. It is notable to mention that the odds ratios for schools with more positive REC shrank considerably once overage was included as a predictor. This likely occurs because overage students are much more likely to be concentrated in CPS high schools with poor than great REC.

Ladson-Billings (2006) argued for scholars to discuss the achievement gap as an education debt that this nation has culminated through harmful policy and practice, whereby

Black and Latine students have been systematically denied access to equal education through a variety of mechanisms. This includes being more likely to attend high poverty schools, be tracked into less rigorous classes, and be exposed to exclusionary discipline. In fact, students' race has been documented to be an important individual characteristic that conditions the way students may experience schooling (Fan et al., 2011). Black and Latine students reported less favorable student–teacher relationships, higher disengagement due to exclusionary disciplinary practices, and less opportunities to participate at school than white students due to decisions such as less likely to be tracked into advanced classes (Voight et al., 2015). When schools promote positive racial equity school climate, these hypothesized mechanisms (e.g., student disengagement) possibly work in a positive direction and underlie the association between positive racial equity school climate and graduation outcomes. Current research, for instance, has suggested schools with positive school climate and schools that implement strategies to improve school racial climate also improve student engagement, student–teacher relationships, and academic performance (Voight et al., 2015). It was no surprise that overage students, who are also disproportionately Black and Latine, were more likely to graduate high school in 4 years if they attended CPS schools characterized by great racial equity. Given findings highlighting the importance of school racial equity climate on graduation outcomes for all students and more importantly for overage students, it will be imperative to implement strategies and programs that improve school racial equity climate in high schools to effectively promote graduation rates for all students, but especially for overage students or students at risk for grade retention.

School Civic Engagement on the Odds of Graduation for Overage Students

School civic engagement climate was measured as students' perception of the extent of civic engagement in their schools. Questions about civic engagement experience in classes

included whether they discussed current events and/or controversial issues, learned about societal issues they care about, were encouraged to consider multiple views on controversial issues, worked on an action project to respond to an issue that impacts their community or society, or participated in simulations or role-plays of civic and political activities. Students who attended high schools with a school civic engagement rated as great had higher odds of graduating high school in 4 years compared to students who attended high schools with poor school civic engagement. There were no significant differences, however, in the relation with school civic engagement and graduation for overage students.

Consistent with prior research, the study findings indicated school civic engagement is associated with academic achievement for all students (Davila & Mora, 2007; Karakos et al., 2016), and not necessarily more or less important for overage students. There are a few hypothesized mechanisms underlying the association between school civic engagement and graduation outcomes. Studies have shown that positive school civic engagement is a possible pathway to student engagement and connection to school and may serve as a buffer against the effects of social, economic, and academic challenges to promote high school completion (Geller et al., 2013; Mahoney & Cairns, 1997; Putnam, 2015; Voight et al., 2020). School curricula that include ways to cultivate students' civic and political knowledge has been found to promote the educational success for young people (Collins, 1990; Paris & Alim, 2017; Sondel et al., 2018). Although there were no strong effects for overage students, positive perceptions of school civic engagement in general can be associated with indirect positive outcomes for the entire school. Karakos et al. (2016), for instance, examined whether a collective of civically engaged middle school students may indirectly influence peers' perception of school climate. They found high levels of civic participation at the grade cohort level, regardless of individual levels of civic

participation, increased positive student–teacher relationships, perceptions of fairness of school rules, and a democratic school climate, which were all associated with high school graduation. Given that the present study findings highlighted the importance of school civic engagement on graduation outcomes for all students, it may be worth further examining how schools can promote and foster positive school civic engagement to effectively promote graduation rates for all students.

The TREF framework offers insight on oppressive processes and inequitable patterns and acknowledges resistance expressed through individual, collective, or institutional action. Schools as political, cultural, and ideologically reproductive spaces often serve as sites of resistance and can support Black and Brown students who are impacted by educational inequity. To put the study findings in this context, racial equity school climate and civic engagement can guide school and policy-level interventions to ensure CPS schools are promoting academic success for all their students, but specifically advocating for overage students or students deemed high risk of retention.

Limitations of the Study

Although this study made a unique and interesting contribution to advance the understanding of school and neighborhood level structures of opportunity and disinvestment as they relate to overage students, findings should be considered in the context of several limitations.

Limitations of the Study Sample

First, although the present study examined four cohorts of overage students across their neighborhoods, elementary schools, and the high schools they attended, this study used one-time point of data (e.g., eighth grade, 12th grade) to answer each research question. Therefore,

conclusions about directionality or causality in the tested associations cannot be made. Thus, the use of a longitudinal design in future research is necessary to disentangle the directionality and temporal relations among the neighborhood and school variables in the present study.

Second, the study sample was limited to CPS students who were overage for grade by the time they entered their ninth grade year. Thus, the study was unable to disentangle differential effects for students who may have failed more than once prior to entering the ninth grade or may have been retained in early versus upper elementary school (e.g., third or sixth grade). Third, students who transferred out of CPS were counted as nongraduates, which means graduation rates in the present study are biased downward. Although graduation rates are lower than the actual rates, they have the advantage of ensuring that students who are mis-coded as transfers did not actually leave school. Additionally, students who received an alternative school diploma were not counted as graduates. Although alternative school diplomas meet state requirements, they do not meet district requirements which are higher and require a college preparatory curriculum. However, this decision limits the ability to examine graduation outcomes for overage students with alternative school diplomas.

Fourth, students who attended any CPS school, except alternative or charter schools, were included in the study. Charter schools and alternative schools were excluded given they have permitted forms of policy flexibility that were not captured in this particular study. However, it is likely overage students may have transferred to alternative schools given their high transfer rate, suggesting a possible limitation in the examination of differential graduation pathways for overage students that is worth examining in future studies. Fifth, Native students could not be included in this study given that only .3% of the sample were overage and made up only .4% of the total CPS sample in this study. In cases like this where quantitative measures do

not have the statistical power to capture the experiences of Native students, qualitative studies are incredibly important to learn about and further understand their experiences.

Limitations of Measures

There were several limitations of the measures used as proxy's for the neighborhood and school level variables included in the study. The study findings supported extant literature that demonstrated an association between education outcomes and green space (Browning & Rigolon, 2019). However, research has demonstrated differential effects of green space on academic achievement. For instance, tree cover, specifically, has been found to be associated with improved test scores and graduation rates (Matsuoka, 2010), and green land cover such as grass or natural parks were found to be associated with academic improvements for youth diagnosed with attention deficit disorder (A. F. Taylor et al., 2001). The present measure on green space, however, did not distinguish potential effects of various green space, such as green land, parks, or tree cover on the odds of being overage for grade.

Perceptions of student–teacher relationships, school safety, racial equity climate, and school civic engagement were limited to student report. Although students are reliable reporters of their own experiences, including an assessment of these school level factors reported by teachers could have a complementary role in identifying their effects on the odds of being overage for grade. Additionally, these same school level factors, perceptions of student–teacher relationships, school safety, racial equity climate, and school civic engagement are administered to effectively a random sample of students in a school each year, limiting knowledge on which classes and students were selected and how many overage students were included in the survey sample. Furthermore, the school civic engagement questionnaire measured the extent to which each student experienced civic engagement in their class. This limited the ability to disentangle

differential effects for perceptions of positive civic engagement in the classroom versus the overall school and could not differentiate effects of civic learning versus action. Lastly, cross-classified analyses with both neighborhood and school level indicators could not be estimated due to its size, limiting the ability to examine the relative effect of these interdependent social contexts on the odds of being overage for grade.

Future Research and Implications

Future Research

Despite these limitations, this study offers several important research implications for future research. First, research engaged in the contribution of social justice-oriented research concerned with the systemic influences of opportunity structures and disinvestment on young people should consider examining policies that impact secure, affordable, and stable housing. Neighborhood factors related to housing and homeownership were related to the probability of being overage for grade even after controlling for race, economic status, and academic achievement. In fact, lack of housing affordability and home ownership were most strongly and persistently significant in this study, suggesting they are most directly tied to the probability of ending elementary school overage for grade. Given there was extant evidence of continual racial discrimination in housing purchases and rentals that prevent access to secure housing for Black and Latine communities (Perry, 2019; Rothstein, 2017), future research on the geographical concentration of Black and Latine overage students should be considered in the context of historical and existing policies as well as the examination of additional structural opportunities and disinvestment in educational (e.g., institutions/schools) and noneducational (e.g., place/neighborhoods) settings that may shape their existence.

Second, the study findings identified which neighborhood and school level characteristics were associated with the odds of being overage. Future studies, however, should examine how these characteristics are mediated through a range of other mechanisms. The effect of homeownership, for instance, is mediated through a range of mechanisms, such as residential stability and security of tenure. Furthermore, unaffordable housing was conceptualized as a single control mechanism, and future research should examine unaffordable housing along different inadequate dimensions (e.g., substandard housing, crowded housing, and affordability problems), which may help to further elucidate the results of this study. Third, future research should attempt to conduct cross-classified analyses because several dimensions of neighborhood–school nexus remain unknown. It is hypothesized the beneficial effects occur through a number of mediating factors, but evidence remains limited on exactly which factors are quantitatively important. Understanding how housing interacts with alternative measures of school structural characteristics or school climate, for instance, would help researchers and policymakers understand the broader range of educational benefits and costs mediated by housing. Conducting cross-classified analyses would advance the understanding on the intricate pathways of education and noneducational opportunity structures associated with the experience of overage students. Fourth, students held back two or more grades, and especially those who have already been retained prior to third grade, have a drastically higher chance of withdrawing from school (Jimerson, 1999; Jimerson et al., 2002a). Thus, examination of these possible differential effects among overage students in relation to neighborhood- and school-level structural factors is worth examining in future research. Additionally, future studies should further examine differential graduation pathways for overage students, such as those who attend charter or alternative schools.

Fifth, Voight et al. (2015) argued there may be microclimates of unique schooling experiences occurring based on student race rather than one school climate experience that is generalized across an entire school. Although the present study did not find significant interaction effects of school climate based on race or sex, the argument of microclimates is worth examining in future research, which can possibly uncover different school climate experiences among racial and ethnic students that was not captured in the present study. Sixth, more research is needed to examine the effects of school civic engagement on overage students. The school civic engagement measure only captured student perspective but did not separate effects of civic learning versus action. Future studies should examine whether mechanisms through civic education and meaning making alone are sufficient to affect student outcomes and success or are positive effects stronger through mechanisms of civic action.

Lastly, future social justice-oriented research concerned with young people deemed high risk of grade retention and not completing high school should (a) continue to engage in systems level thinking and extend the multilevel approach to examine other forms of systemic influences of opportunity structures and disinvestments on their outcomes, (b) use the TREF framework as a guide to examine the effect of these factors on another cohort of students who have high incidences of not completing high school (e.g., economically disadvantaged Black and Latine students who experience behavioral health crises or suspensions), and (c) engage in qualitative work to understand how these young people negotiate, respond, and make meaning of their lived experiences and examine the nonlinear pathways that lead to the categorization of "high-risk" students for grade retention, and the factors that seem to act as facilitators for not completing high school.

Implications for Theory

The current sociopolitical moment calls academic disciplines, especially social work, to address racism and white supremacy across the multiple systems and levels at which social workers intervene. Yet, current dominant theoretical frameworks in social work, psychology, and education—particularly the ecological systems framework—are ahistorical, apolitical, and sideline broader systemic patterns that aide in inequitable distributions of opportunities and disinvestments, thereby impeding disciplines' abilities to foster an antiracist future across multiple domains. Too often current social work frameworks offer strategies and practices to support client resilience and educational or vocational success. Although essential, the underlying logic and implementation of existing pedagogies are rooted in epistemologies and practices that focus the locus of the problem in the individual instead of on the inequitable structures BIPOC must navigate across their lifetime. The TREF designed with a social justice approach illuminates how inequity (in this case students who are overage for grade) are embedded in multiple and complex layers of society, elucidating the assets and resistance of communities of color and schools located in neighborhoods that have experienced disinvestment. The TREF used as a guide to frame the study and interpretation of the findings —particularly in connection to historical and present-day racial inequities—has imperative implications on future research, such as countering efforts to explain away the effects of systemic factors on overage students who are disproportionately Black and Latine. Future research can leverage this theoretical framework to advance the understanding and illuminate both the structural opportunities and inequities that young people have access to which will allow intervention at the systemic level through tangible policy solutions.

Implications for Policy

Access to safe, affordable, and stable housing are fundamental structures of opportunity associated with positive education outcomes (Whelan, 2017). President Biden's $2 trillion Build Back Better Act had a promise of allocating more than $300 billion to invest in housing and expand affordable housing programs (U.S. Committee on Financial Services, 2022). Funds were proposed to put $10 billion toward the HOME Investment Partnership Program for home construction and rehabilitation, allocate $10 billion for first-generation homebuyers and down payment assistance, retrofit over 1.8 million affordable housing units, and proposed billions more for mortgage subsidies, zoning and land reform, and other programs. The revised version by the House in November 2021, however, cut the housing allocation to $150 billion over 10 years, with recent talks of considerably revising the housing budget or even possibly taking it off the table completely (Folley, 2022). Senator Brian Schatz (D-Hawaii), chairman of the Senate Appropriations housing subcommittee frankly stated, "I think that the realistic pathway for a housing budget resolution is something more narrow, and we have to start telling the truth about that" (Folley, 2022, p. 1).

Given what is known about the limited funds allocated to housing budgets (and pending the Build Back Better Act), findings from the present study provide insight on where federal or local funds can be leveraged to increase access to affordable and secure housing, most effectively. The study findings showed census tracts with greater than 51% of households paying more than 30% of their income on housing, census tracts with less than 32% of homeowners, and census tracts with poverty rates greater than 2 standard deviations above the mean have the highest risk for having the greatest odds of overage students. As evidence suggested that education-related benefits from homeownership are strongest for households living in high

poverty (Ghimire, 2021), it may be more effective to design policies that target specific census tracts in ways that directly address the particular challenges faced in each tract using the study's findings. Targeted policies directed to these census tracts may provide greater education-related benefits for students overage for grade or for students at risk for grade retention.

Local government can also play an important role in improving homeownership rates and affordable housing. Local government, for instance, can continue to invest in programs that reclaim abandoned properties or vacant lots and put them in the hands of community organizations and neighbors to help residents acquire properties at below market rate. The Large Lot Program, for instance, was a City of Chicago initiative that sold vacant residential lots for $1 in select Chicago neighborhoods that could be transformed for housing, gardens, or expanding the yard of existing homes (City of Chicago, 2022). Department of Planning and Development is currently developing a new land sale program that builds on lessons from the Large Lots program and plans to engage with neighbors, community development organizations, and City Council to inform their strategic plan (City of Chicago, 2022). The study's findings could also help inform a systemic, comprehensive plan that could incorporate the implementation of needs assessments at the census tract level that may carry education benefits for CPS students. Housing security not only matters in itself but also for student outcomes in school. Findings suggested policies that increase housing affordability and home ownership might be particularly beneficial for preventing students from becoming overage for grade, and indirectly improving graduation rates.

In a recent example of a systemic, comprehensive intervention, Kelleher et al. (2018) recognized a systemic pattern experienced by the youth patients they treated in the hospital. As a result of structural patterns of opportunity and disinvestment, a majority of their chronic patients

were impacted by residential and school mobility. To systematically disrupt this pattern of inequity, Kelleher and his treatment team decided to target the neighborhood as their patient rather than focus on the individual patient. Kelleher et al. (2018) profoundly stated, “If zip code is an enduring driver of both short-term and long-term health, children’s hospitals and other health care facilities as anchor institutions should be in the zip code improvement business” (p. 7). Kelleher and his treatment team targeted Southern Orchids community of Columbus, OH. The community was predominately Black and systematically racially segregated, 50% of young people were living in poverty, over 50% stated they were housing-cost burdened (i.e., housing costs > 35% of income), had a high rate of housing instability and homelessness, had a 21% foreclosure rate, 31% of properties and lots were abandoned or vacant, and it was physically separated from downtown Columbus due to the construction of major urban highways. Through their home repair program, rental housing development, and home ownership program they were able to rehabilitate the homes and sell predominantly to persons with an income less than or equal to 120% of the area with down payment assistance; 10 homes per year were and continue to be sold this way, with a focus on growing outward from the school buildings one block at a time. They also focused on increasing employment opportunities and worked on building out afterschool programs for young people. In response to their multifaceted structural intervention, the local high school graduation rate rose from 64% to 79%, there was a 50% increase in single family homes, and there have been no reported homicides in 2 straight years (Kelleher et al., 2018).

Furthermore, another systems-level approach were local and federal funds should be allocated is toward organizations that focus on building parks and related infrastructure in communities and might be particularly beneficial for preventing students from becoming overage

for grade, and indirectly improving graduation rates. An organization called Kaboom for instance uses a system-level assessment to identify inequitable access to quality play spaces and engage in community-build safe playgrounds in the targeted neighborhoods. Given what we know about the effects of green space on academic outcomes and particularly for overage students, funds that support green space development from the Build Back Better Act (U.S. Committee on Financial Services, 2022) should be allocated to organizations like Kaboom to grow trees, shrubs, or grass in their playgrounds to further support their mission. Systems-level approaches that focus on increasing affordable housing, expanding homeownership, or increasing access to green space is possible (KABOOM, 2021; Kelleher et al., 2018). However, sustainable long-term approaches require coordination and financial support among various levels of government—federal, state, and local—in implementing these systemic, comprehensive plans.

Education Policy With Practice Implications

High suspension rates and high poverty are signals that schools need more supports. Schools cannot control the poverty level of the students they serve. They can, however, control discipline practices and how suspensions and other practices are used. Research has shown many promising outcomes in schools that implement restorative justice practice in response to student discipline challenges, including lower retention rates, improved school racial climate, and higher academic achievement (Gardella, 2015; Glenn et al., 2021). A universal school level intervention that focuses on restorative practice and intentionally builds toward an enriching and supportive school climate for all students, but particularly for overage students, is essential to ensure students experience their schools as inclusive, supportive, and racially equitable. Racial equity school climate in this study specifically measured the extent to which CPS students perceived race as a driving influence on crucial decisions at their school, including discipline decisions,

adult's expectations, access to advanced courses, and the overall quality of education students receive in CPS. The study's findings suggested that CPS students who attend schools with great racial equity have higher odds of graduating in 4 years, especially students who are overage for grade. Thus, part of the school level intervention should focus on professional development trainings for school personnel that aim at uncovering how discipline policies, decisions, and beliefs about the general behavioral presentation of Black and Latine students may be contributing to the disproportionate rate of nongraduates for both at-age and overage students. If education administrators or policy makers try to change discipline policy or other school decisions that disproportionately harm Black and Latine young people without engaging in the knowledge, beliefs, and practices of those directly impacting them, they will have a failed attempt in effectively increasing graduation outcomes, especially for overage students.

This project also offers a way for student support teams that may include school social workers, counselors, teachers, and special education interventionists to observe and imagine structural intervention for overage students or students deemed at-risk for grade retention. By shifting the focus on systems, student support teams are able to understand the families and students they encounter are often negatively impacted by intergenerational structural and institutional racism, recognizing the strength and resistance they possess to function in a system not made for them. For example, an overage student who is struggling with absenteeism might be interpreted as a completely appropriate response to systemic disinvestment (e.g., unstable housing) and will allow schools to serve as sites of resistance (e.g., positive racial equity climate) or focus effort on systemic intervention (e.g., affordable housing). This reorientation can guide school districts' ongoing efforts to improve educational equity by acknowledging that a collaborative approach for systemic intervention will be required in response to the overage

epidemic; not students' individual, rational-linear decision making as the sole driver. Furthermore, implications of this project may enhance educators, school administration, teachers, and school social workers insight on alternative practices when making decisions to retain students and support overage students.

Social Work Implications

This project offers a way for social workers to observe and imagine structural intervention from their historically fraught role as both insiders and outsiders to communities facing oppression. By shifting the focus on systems, social workers are also able to understand the communities and individuals they work with are often negatively impacted by intergenerational structural and institutional racism and recognize the strength and resistance they possess to function in a system not made for them. The TREF framework, an extension of Bronfenbrenner (1984) that is popularly used in social work, can be used as a guide by social workers to highlight and think critically about issues such as racial inequities (e.g., students deemed high risk of not completing high school) across systems (e.g., carceral state, education) in which they work. Social workers can bring these critical perspectives that examine multilevel systems in which they are located to reimagine structural intervention and help counter efforts based solely on reductionist or individualistic risk factors for their clients. It is the hope that social workers will reflect on the strategies required to effectively advocate for the clients they work with, and to foster an antiracist future across multiple practice domains.

Conclusion

This study contributes to a growing body of social justice-oriented research concerned with the systemic influences of opportunity structures and disinvestment/lack of investment, conceptualized as the patterns, options, supports, and access to resources that shape the

opportunities for young people (Astor et al., 2021; P. L. Carter & Welner, 2013). Particularly, the study accomplished three main goals: (a) examined how the distribution of students overage for grade overlap with historically racialized assignments of urban space (i.e., redlining; see Appendix A), (b) advanced understanding of school and neighborhood level structures of opportunity and lack of investments/divestment as they relate to students overage for grade and opportunities for intervention at the systemic level, and (c) examined which school factors promote the success of students who are overage for grade to identify the extent to which school practices and climate currently make a difference. Characteristics of neighborhoods and schools that are associated with higher probabilities of retention pointed to potential tools for helping prevent retention, which can guide future policy and practice work. Research, policy, and practice aimed to seriously disrupt mechanisms of inequity have to center young people who have historically and systematically had the least access to resources and have to be the focus of future work and equity undertakings.

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Appendix A: The Spatial Distribution of CPS Overage Students in Relation to Historically Racialized Assignments of Urban Space

The Chicago neighborhoods with the highest concentration of students that enter high school as being overage freshman are on the West and South sides of Chicago (Chicago Public Schools [CPS], 2014), which are historically racialized assignments of urban space for Black and Latine young people. I examined how the spatial distribution of ninth grade CPS overage students in Chicago, 2012–2015 students relate to historically racialized assignments of urban space, particularly in relation to the 1930's Home Owner's Loan Corporation redlining maps.

Data Analytic Strategy: Analyses were conducted to provide descriptive information about the overage status (0 = at-age, 1 = overage) of CPS students first time freshmen in fall of 2012–2015 and the census tract in which they reside. This information was used to visually map how overage students were spatially distributed across Chicago. To begin the geocoding process, frequencies of total overage and at-age ninth graders for each census tract were calculated. A tidy dataset was created from the student and census tract variables and exported as a CSV file, which was then uploaded to ArcGIS Online to turn it into an appropriate file for GIS mapping. A tidy dataset is a standard method of displaying the data in the form of a data matrix in preparation for GIS mapping. The dataset was then geocoded and downloaded as a shapefile for use in QGIS 3.12. A spatial join in QGIS was then conducted with the 2010 census tract shapefile for Chicago. Next, the Home Owners Loan Corporation (HOLC) polygon map for Chicago was uploaded to QGIS and was used to overlay with the student census tract shapefile. Finally, using QGIS, two-dimensional maps of Chicago were created to visualize the ratio of CPS student overage for grade to CPS students at-age in each census tract.

The Spatial Distribution of CPS Overage Students in Relation to the 1930s Home Owner's Loan Corporation Redlining Maps

The spatial distribution of overage students between 2012 and 2015 in relation to the 1930s HOLC redlining map is presented through a series of maps. Census tracts were color coded by the same color key that was used to redline Chicago neighborhoods in the 1930s. Green indicated the "best" neighborhoods to provide individuals and families housing loans and were given a Grade A. Areas colored blue were considered "still desirable" and given a Grade B. Yellow areas were considered "declining" and were given a Grade C. Areas colored red were considered "hazardous" and were given the worst Grade, D. To visually observe the distribution of overage students as an overlay with the HOLC map, the color coding for the five groups was changed to a color outline. Census tracts outlined in purple indicate census tracts with the lowest percentage of overage CPS students, and census tracts outlined in light blue indicate second lowest percentage of overage CPS students. Census tracts outlined in sky blue indicate third highest percentage of overage CPS students, standard blue indicate second highest percentage of overage students, and census tracts outlined in dark blue indicate census tracts with the highest percentage of overage CPS students (see Key in Figure A.1).

The figures are presented in a series of five maps. Each map provides a visual point of comparison to examine the spatial distribution of each group in relation to the HOLC redlining map. For instance, Figure A.1 shows the distribution of the highest percentage (i.e., Group 5) of ninth grade overage CPS students as it relates to previously redlined neighborhoods across Chicago. The highest percentage of overage students are in neighborhoods that were deemed hazardous (i.e., Grade D) or declining (i.e., Grade C) in the 1930s. Individuals and families that lived in these neighborhoods were heavily restricted or blocked from receiving home loans due

to this redlining strategy. Figure A.2 shows that the second highest percentage of overage students are distributed across neighborhoods that have been previously deemed hazardous, declining, or still desirable; however, an overwhelmingly majority are in yellow neighborhoods that were given a Grade C. Figures A.3–A.5 show that the three groups, 1st, 2nd and 3rd lowest percentage of overage students, are lightly distributed across Chicago, away from most of the heavily redlined south and west neighborhoods of Chicago. In fact, majority of the lowest percentage of overage students are concentrated in the far north and far west corridors of the city. Although redlining was a technique used in the 1930s to restrict Black and Brown people from receiving Home Loans, evident in these four maps is that the concentration of CPS overage students in 2012–2015 correspond with the color-coded redlined Chicago areas of the 1930s HOLC Map. Most of the highest percentage of overage students, for instance, are in red areas (i.e., Grade D), with the majority of the second highest percentage of overage students located in yellow areas (i.e., Grade C), and most of the lowest percentage of overage students are in neighborhoods that are color coded blue (i.e., Grade B) or green (i.e., Grade A).

Figure A.1

Distribution of Highest Percentage of Overage CPS Students in Relation to Formerly Redlined Areas in Chicago

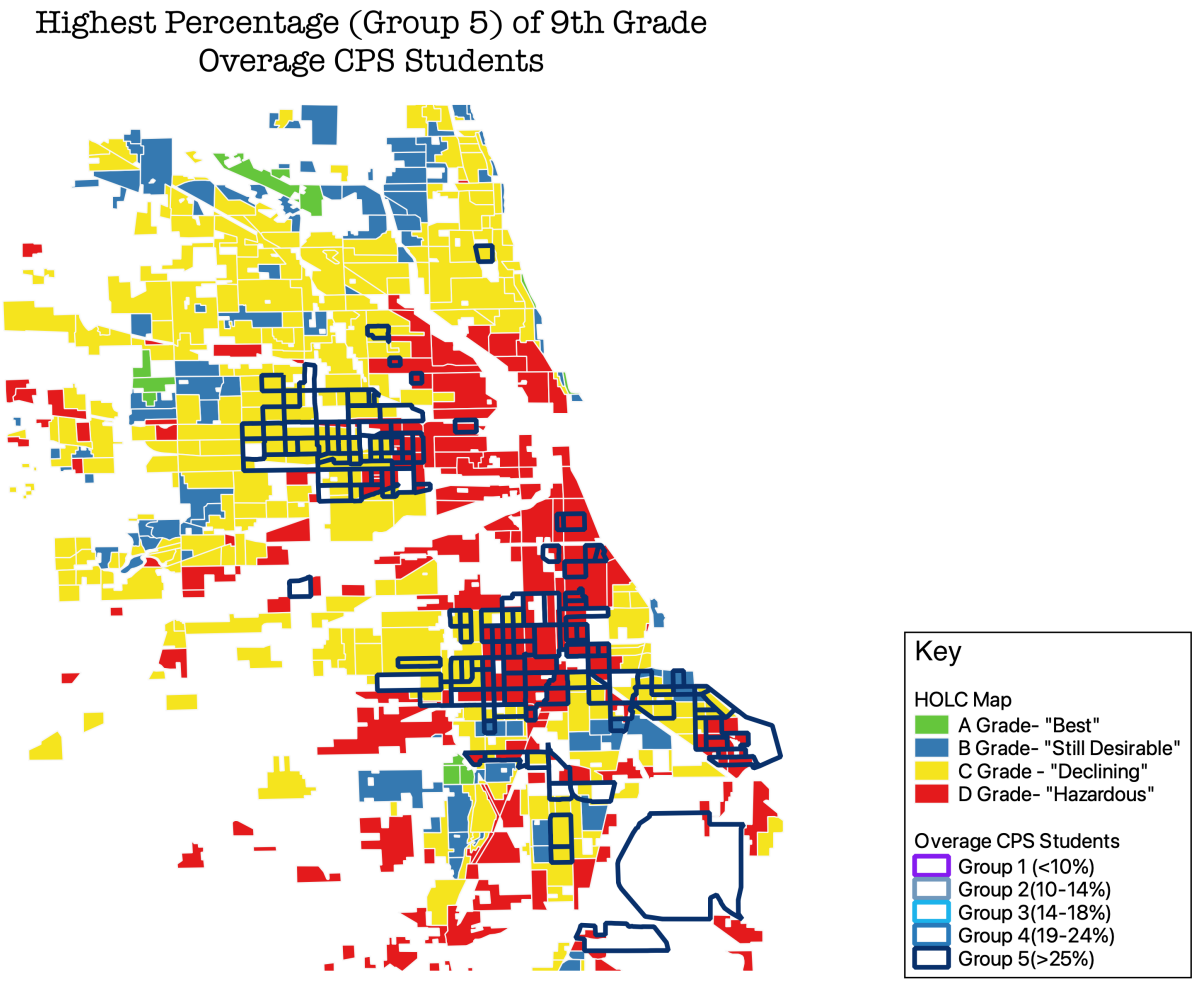

Figure A.2

Distribution of Second Highest Percentage of Overage CPS Students in Relation to Formerly Redlined Areas in Chicago

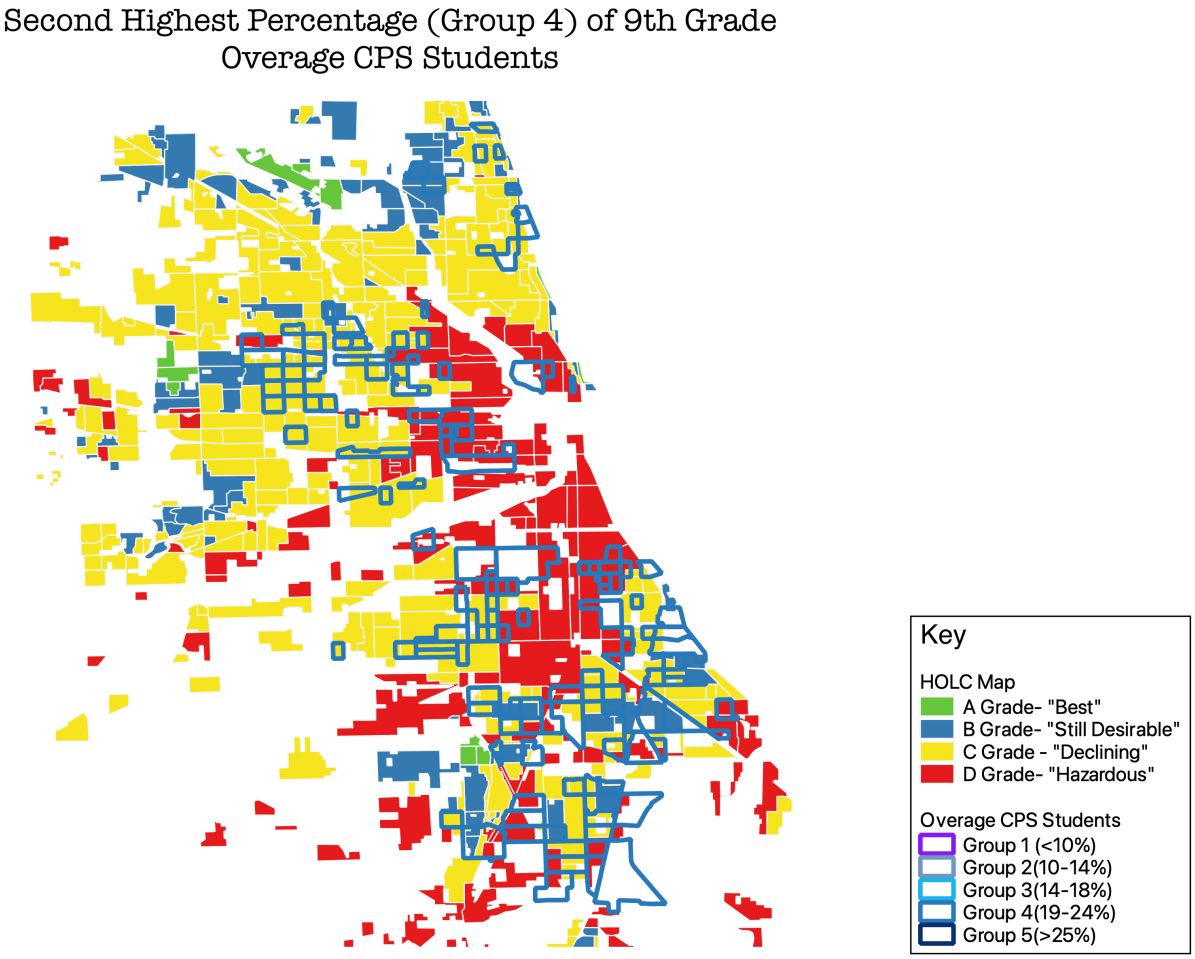

Figure A.3

Distribution of Third Highest Percentage of Overage CPS Students in Relation to Formerly Redlined Areas in Chicago

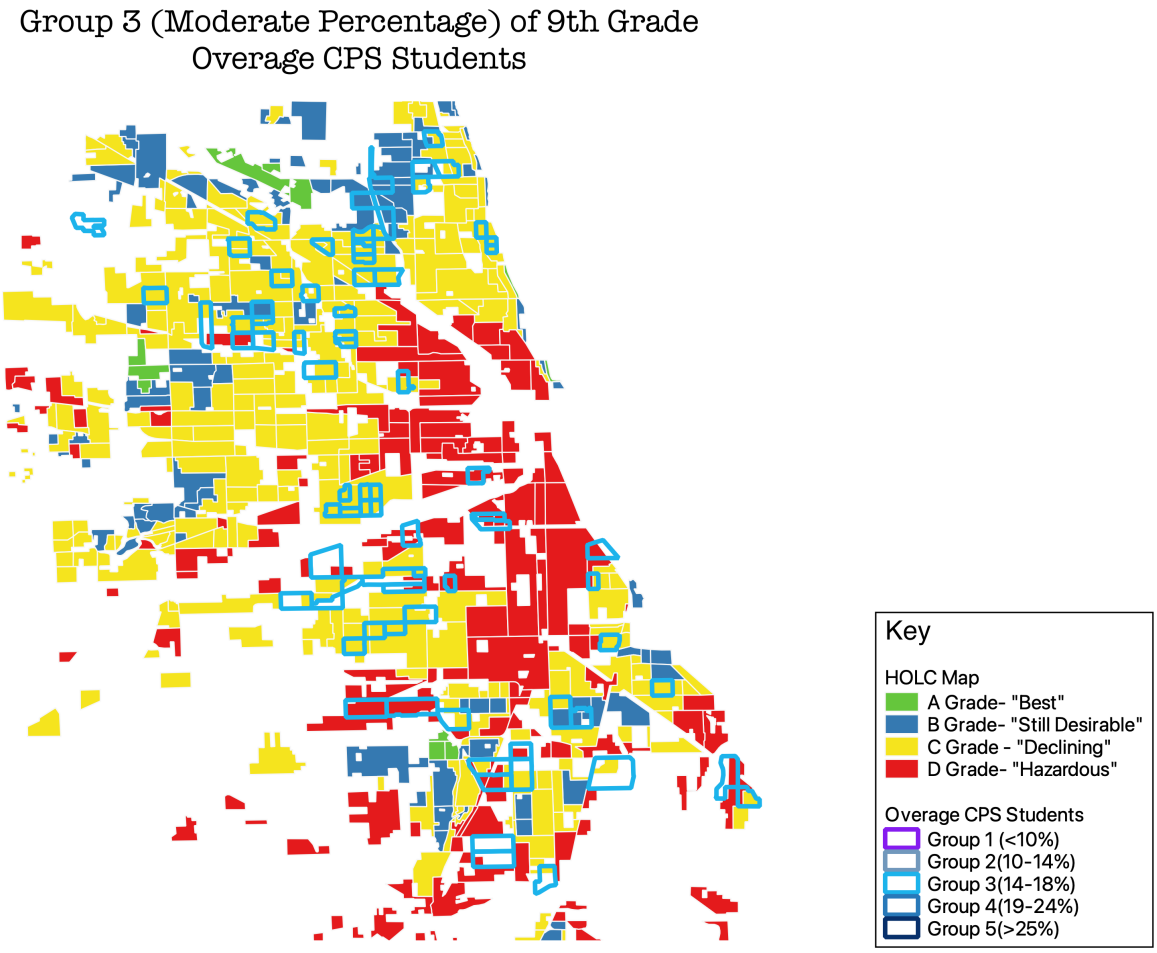

Figure A.4

Distribution of Second Lowest Percentage of Overage CPS Students in Relation to Formerly Redlined Areas in Chicago

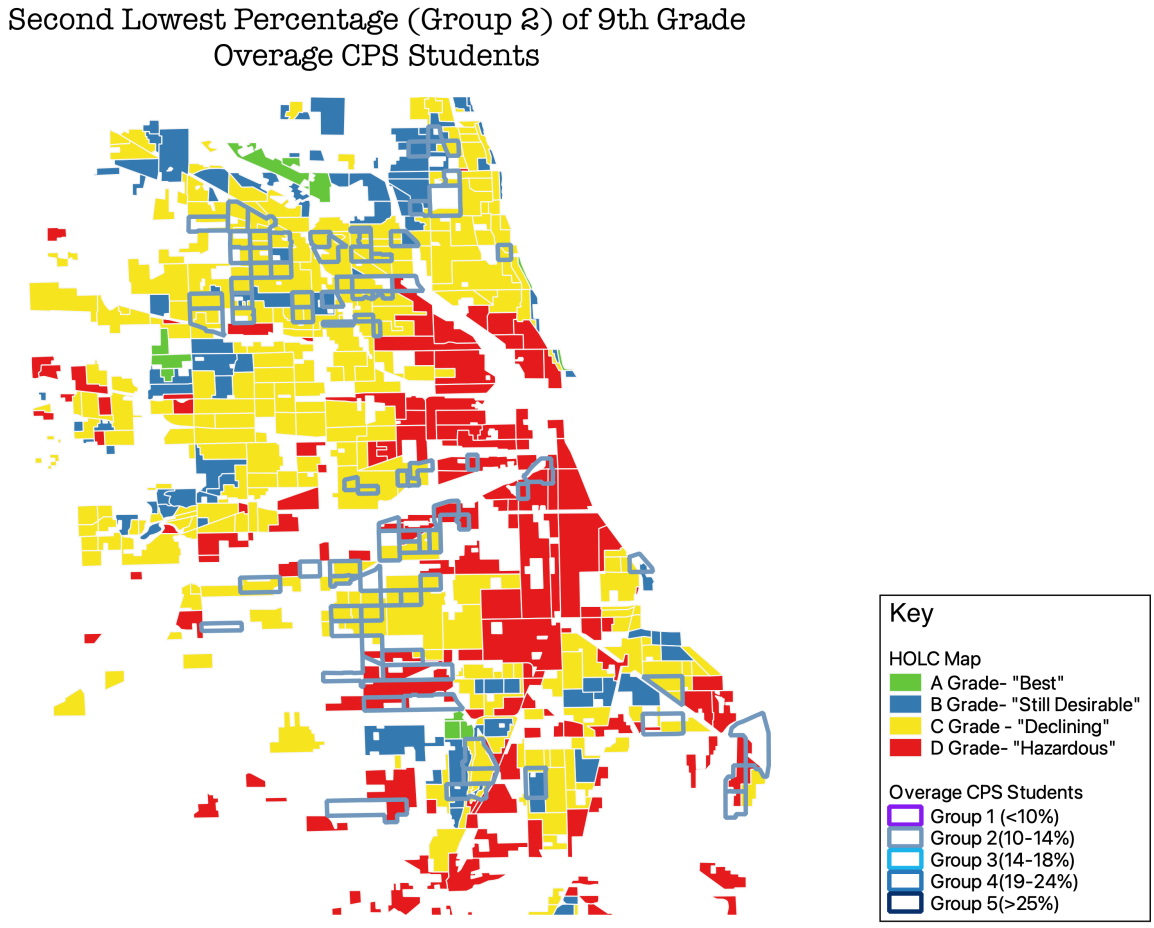

Figure A.5

Distribution of Lowest Percentage of Overage CPS Students as it Relates to Redlined Areas in Chicago

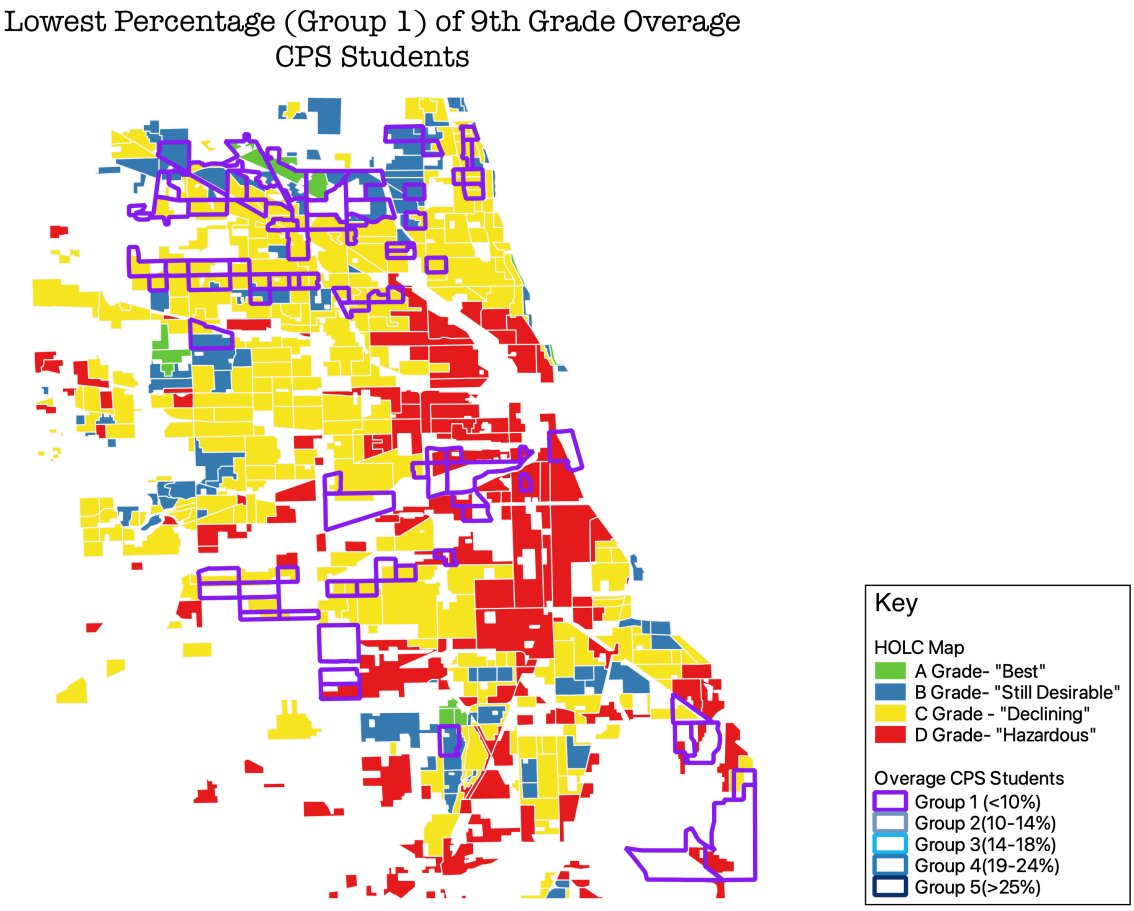

Figure A.6 shows there are a few census tracts with highest percentage of overage students that share boundaries with census tracts with lowest percentage of overage students in previously redlined red and yellow neighborhoods (see Figure A.7 for a magnified selection of the map). To further examine this, a couple of census tracts were selected from the highest and lowest percentage of overage students that were adjacent to one another. Census tract 2106.02 is situated in the Avondale community and adjacent census tract 2206.02 is situated in the Logan Square community (see Figure A.7). Although they share a census boundary and were both redlined with a "C" Grade, their overage student percentage for 2012–2015 is vastly different. Census tract 2106.02 has an overage percentage of less than 10%, and census tract 2206.02 has an overage percentage close to 30. According to a 2013 report from the Chicago Rehab Network and a 2021 report from the Institute for Housing Studies, the community lost about 10% of family households and 16.5% of their lower-income renters between 2000 and 2010, whereas higher-income renters and homeownership rates rose about 2.4 percentage points. Table A.1 illustrates this point by showing the greatest difference between the two neighborhoods lies in homeownership rates followed by unaffordable housing. Census tract 2106.02 in Avondale, for instance, consists of 44% of homeowners, and census tract 2206.02 in Logan Square consists of 23%.

Figure A.6

Highest and Lowest Percentage of Overage CPS Students in Relation to Redlined Areas in Chicago

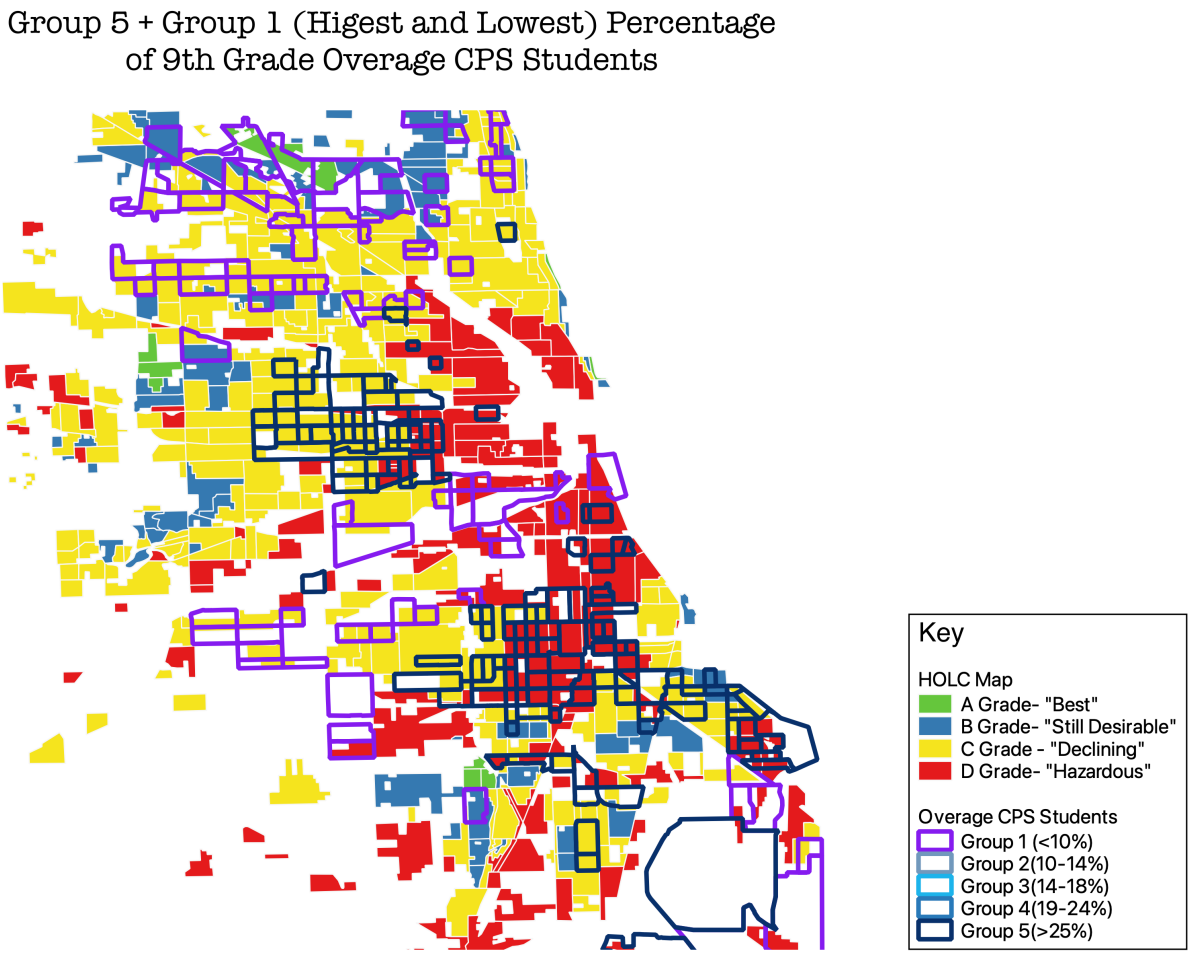

Figure A.7

Magnified Highest (Group 5) and Lowest Percentage (Group 1) of Overage CPS Students in Relation to Redlined Areas in Chicago

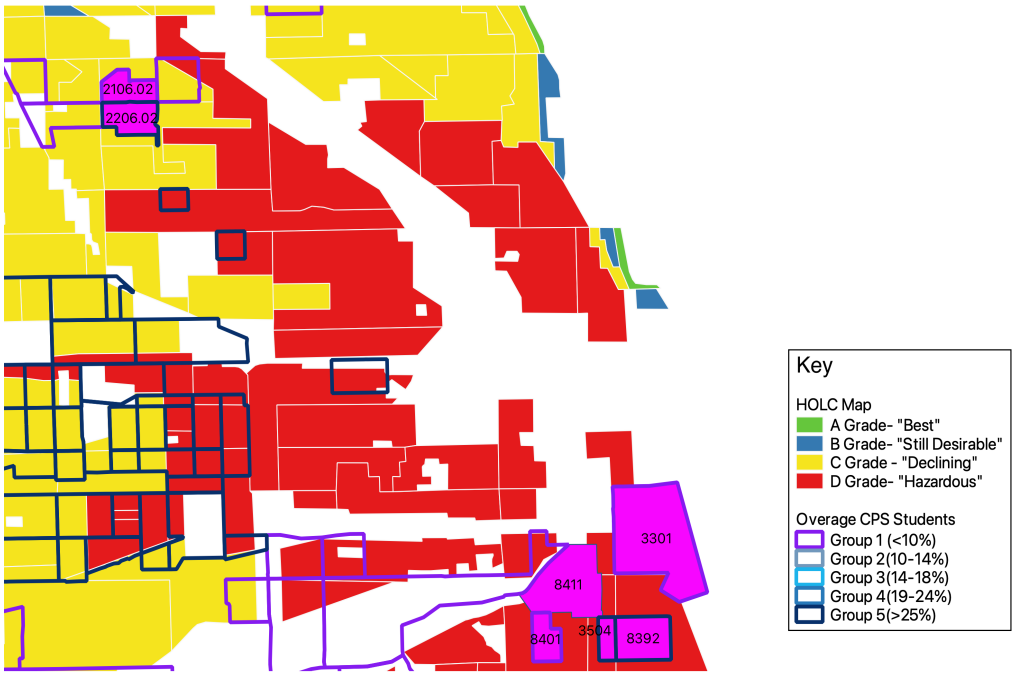

Table A.1

Neighborhood Stats Comparison for Census Tracts With Highest and Lowest Overage Students in Formerly Redlined "Declining" Areas

Neighborhood stats	2106.02/Avondale	2206.02/Logan Square
% overage students	9.5 (low-group 1)	29.9 (high-group 5)
Home ownership	40%	25%
(Un)affordable housing	40.2%	46%
(Limited) access to supermarket	0	0
Green space	74%	72%
Neighborhood poverty	.3 above *M*	.4 *SD* above *M*

The same strategy was conducted for adjacent census tracts with highest and lowest percentage of overage students in formerly redlined "Hazardous" areas (see Table A.2; see Figure A.7 for a magnified selection of the map) and for census tracts with highest and second highest percentage of overage students in formerly redlined "Hazardous" areas (see Table A.3; see Figure A.9 for a magnified selection of the map). Whether the adjacent census tracts are a difference of highest and second highest percentage of overage students, or a difference of highest and lowest percentage of overage students, a similar trend showing consistent differences in home ownership between the two groups is seen. There is also some variation in differences in unaffordable housing and green space. The role of these neighborhood level factors on the odds of being overage were examined in specific Aim 1b in a multilevel mixed effects logistic regression analysis.

Table A.2

Neighborhood Stats Comparison for Census Tracts With Highest and Lowest Overage Students in Formerly Redlined "Hazardous" Areas

Neighborhood stats	3504/ Douglas	8392/ Douglas	3301/ Near South Side	8401/ Bridgeport
% overage students	33% (high-group 5)	27% (high- group 5)	8.5% (low- group 1)	5.4% (low- group 1)
Home ownership	0%	29%	55%	43%
(Un)affordable housing	40%	56%	35%	48%
(Limited) access to supermarket	0	.5%	.4%	0
Green space	60%	60.8%	79.5%	83.5%
Neighborhood poverty	1.1 *SD* above *M*	.4 *SD* above *M*	.1 *SD* above the *M*	1 *SD* above the *M*

Figure A.8

Highest and Second Highest Percentage of Overage CPS Students in Relation to Redlined Areas in Chicago

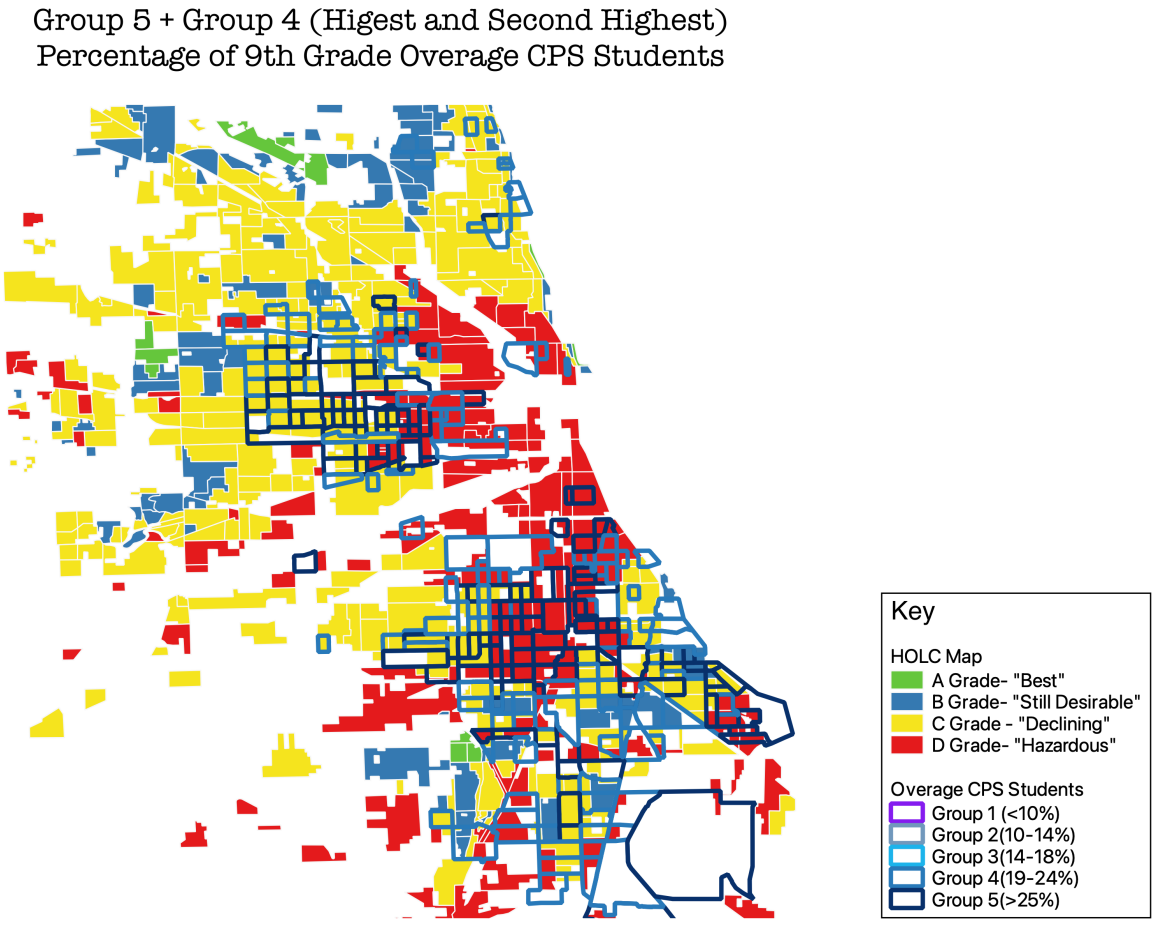

Figure A.9

Magnified Highest and Second Highest Percentage of Overage CPS Students in Relation to Redlined Areas in Chicago

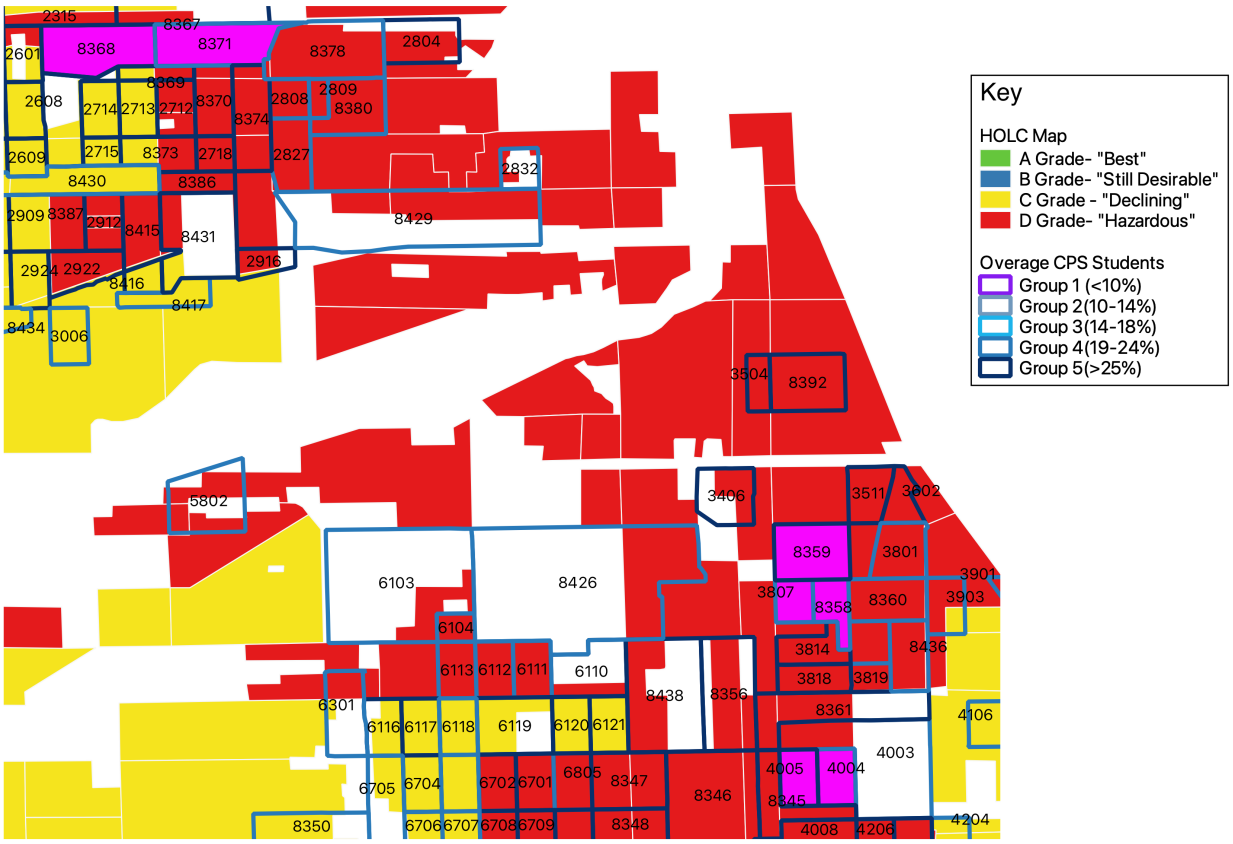

Table A.3

Neighborhood Stats Comparison for Census Tracts With Highest and Second Highest Overage Student Percentage in Formerly Redlined "Hazardous" Areas

Neighborhood stats	4005 (Washington Park)	4004 (Washington Park)	8359 (Grand Boulevard)	8358 (Grand Boulevard)	8368 (East Garfield Park)	8371 (East Garfield Park)
% overage students	37.6% (Group 5)	23% (Group 4)	27.5 % (Group 5)	20% (Group 4)	38 % (Group 5)	21% (Group 4)
Home ownership	15%	24%	16%	39.3%	19%	32%
(Un)affordable housing	55%	53.4%	48.1%	45.9%	63%	59%
(Limited) access to supermarket	0	0	7.2%	0	34.8%	46.5%
Green space	64.5%	67.4%	65.2%	65.1%	68.5%	65.1%
Neighborhood poverty	1.06 *SD* above *M*	1.06 *SD* above *M*	1.35 *SD* above *M*	1 *SD* above the *M*	1 *SD* above the *M*	1.7 *SD* above *M*

Place/Neighborhood

Achieving education equity across racial and socioeconomic lines requires better understanding of how historic discriminatory policies, such as the 1930s, HOLC redlining maps, continue to shape current patterns of inequities across the United States and how the effects may linger and influence the socioeconomic and structural landscapes of neighborhoods today. An examination of the context of place in the present study showed that the distribution of ninth grade CPS overage students between 2012–2015 were spatially concentrated on the west and south sides of Chicago, home to predominantly Black and Latine communities. Furthermore, the concentration of CPS overage students between 2012–2015 correspond with the redlined Chicago areas of the 1930s HOLC map. The census tracts with the highest percentage of overage students, for instance, were the same as those deemed "hazardous" (i.e., Grade D) in the HOLC

map. The pattern continued with the majority of the second highest percentage of overage students overlapping with areas that were deemed "declining" (i..e, Grade C), and the areas with the lowest percentage of overage students were concentrated in Chicago census tracts that overlap with neighborhoods that were historically deemed "still desirable" (i.e., Grade B) or "best" (i.e., Grade A).

These findings corroborated those of recent studies that examined the generational effects of redlining (Aaronson et al., 2021; K. A. Park & Quercia, 2020). These studies showed the practice of preventing access to secure housing and related housing opportunities through redlining techniques in neighborhoods deemed hazardous or declining resulted in place-based differences in the life-course outcomes for young people growing up generations later (Aaronson et al., 2021; Greenwich, 2018; Manduca & Sampson 2019; K. A. Park & Quercia 2020; Roithmayr, 2004; Rothstein, 2017). Greenwich (2018), for instance, examined high school dropouts in Rochester, New York and found that the highest concentration of high school dropouts overlap almost identically with the areas that were redlined nearly a century ago and correspondingly continue to experience the highest rates of poverty. Aaronson et al. (2021) found remarkable differences across 30 U.S. cities in the economic opportunities, socioeconomic success, probability of incarceration, and geographic mobility for residents residing in historically redlined neighborhoods compared to neighborhoods that had similar preexisting differences but did not fall in a HOLC boundary; for instance, young people who were raised in the historically redlined Watts community of Los Angeles were more likely to have experienced incarceration and have lower income as adults compared to their counterparts that were raised only a short distance away in Compton. This study adds a unique contribution to the literature as

it is the first to examine how historical and generational effects of redlining manifests geographically for overage students.

Investment grades assigned by HOLC maps that designated investment risk for Black and Brown communities reinforced and perpetuated racial residential segregation, financial disinvestment, prevented access to secure and stable housing, and shifted economic capital away from Black and Brown communities (Perry, 2019; Rothstein, 2017). Roithmayr (2004) refers to this process as "locked-in segregation" in which many people who reside in high burden and systematically segregated neighborhoods are trapped into patterns of inequity that determine life chances, health and well-being, and access and opportunities to adequate housing, financial stability and education for generations to come. To put the study findings in the context of the guiding TREF conceptual framework, the second layer of the TREF model emphasizes racial ideologies embedded in governance; defined here as the materialization of societal ideologies through private or public policy, practices, and funding structures that enforce the racial politics of everyday life (The Transdisciplinary Resistance Collective for Research and Policy et al., 2020). Racial ideologies that have been historically and systematically embedded in policies and practices, such as redlining through HOLC, have contributed to the creation of conditions such as racially segregated high burden neighborhoods. The policies that justify racialized inequitable practices essentially influence which neighborhoods are divested from and which communities get access to resources.

Redlining is only one of many methods that have produced inequitable distributions of access and opportunity for Black and Latine communities. Despite policies such as the Fair Housing Act of 1968 that outlawed exclusionary zoning policies, there is extant evidence of continual racial discrimination in housing purchases and rentals that ultimately aimed to do the

same thing to prevent access to secure housing and shift economic capital away from Black and Brown communities (Perry, 2019; Rothstein, 2017). This study's findings provide striking evidence of how the impact of policies, along with persistent racism and economic inequity, can have broad and long-lasting consequences ultimately creating and sustaining communities with greater or lesser opportunity. It is by no surprise then those neighborhoods associated with the most disadvantaged and historically unequal inputs of opportunity and disinvestment have the highest rate of overage students despite decades of urban social transformations. The strong relationships of home ownership and unaffordable housing provide suggests the lack of homeownership and affordable housing resulting from lack of capital and disinvestment are most directly tied to the probability of ending elementary school overage for grade. It is therefore a reminder that to understand the landscape of urban inequity that exists today, and in this case education inequity, scholars, educators, and policy makers must look to the past and present examine the unfolding consequences of social policies implemented many decades ago.

Appendix B: Scales

Students' Perception of Student-Teacher Trust Scale

How much do you agree with the following: 1 Strongly disagree 2 Disagree 3 Agree 4 Strongly agree
I feel safe with my teachers at this school.
I feel comfortable with my teachers at this school.
My teachers always keep their promises.
My teachers always listen to students' ideas.
My teachers treat me with respect.

Students' Perception of School Safety Scale

How safe do you feel: 1 Not Safe 2 Somewhat Safe 3 Mostly Safe 4 Very Safe
In the hallways of the school?
In the bathrooms of the school?
Outside around the school?
Traveling between home and school?
In your classes?

Students' Perception of Racial Equity Climate Scale

How much do you agree with the following: 1 Strongly disagree 2 Disagree 3 Agree 4 Strongly agree
Race is a factor in decisions about discipline at this school.
Race influences adult's expectations for students at this school.
Race influences whether students have access to advanced courses (AP, IB, honors).
Race influences the overall quality of education that students receive in CPS.

Students' Perception of School Civic Engagement Scale

This year, in my classes,
I have learned about societal issues that I care about.
I am encouraged to consider multiple views on controversial issues.
I worked on an action project to respond to an issue that impacts my community or society.
I have discussed current events and/or controversial issues.
I was involved in a project that improves my school or community
I have participated in simulations or role-plays of civic and political activities (such as debates, town hall meetings, hearings, elections, campaigns, trials, or Model UN).

Appendix C: Descriptive Statistics and Tests for Skewness and Kurtosis

Table C.1

Descriptive Statistics and Tests for Skewness and Kurtosis of Neighborhood Variables

Variable	MIN	MAX	*M*	*SD*	SKEWNESS		KURTOSIS	
	Stat	Stat	Stat	Stat	Stat	Std. Error	Stat	Std. Error
Affordable housing	11.1	70.69	44.23	9.97	-0.18	0.09	2.7	0.17
Home ownership	0	98.56	46.76	19.85	0.28	0.09	2.45	0.17
Green space	13.3	92.7	65.4	10.68	-0.57	0.09	2.8	0.17
(Limited) access to supermarket	0	79	46	19.53	0.4	0.09	1.9	0.17
Poverty	-2.7	4.05	.22	.82	-.57	0.09	3.7	0.17

Table C.2

Descriptive Statistics and Tests for Skewness and Kurtosis of School Variables

Variable	MIN	MAX	*M*	*SD*	SKEWNESS		KURTOSIS	
	Stat	Stat	Stat	Stat	Stat	Std. Error	Stat	Std. Error
Student–Teacher trust	1.7	4	3.1	.2	-0.13	0.12	1.6	0.23
School safety	1.8	4	3.1	.23	0.09	0.12	1.6	0.23
Suspension rate	0	.26	0.01	.16	1.7	0.12	4	0.23
School poverty	-1.7	2.2	0.13	.45	.001	0.12	2.9	0.23
Racial equity school climate	-4	2.5	-.23	.75	-0.2	0.24	3.2	0.48
School civic engagement	-1.8	3.73	.01	.72	0.01	0.24	1.7	0.48

Tables C.3

Descriptive Statistics and Tests for Skewness and Kurtosis of Student Variables

Variable	MIN	MAX	*M*	*SD*	SKEWNESS		KURTOSIS	
	Stat	Stat	Stat	Stat	Stat	Std. Error	Stat	Std. Error
NWEA reading	1	99	55.67	26.86	-0.35	0.12	2.10	0.23
NWEA math	1	99	54.29	28.93	-0.19	0.12	1.88	0.23
Absences	0	65	10.06	11.46	-.002	0.12	1.63	0.23
Suspensions	0	.26	0.006	.016	1.74	0.12	4	0.23
Failed courses	0	13	.39	1.09	1.72	0.12	3.94	0.23