Student Mobility and Violent Crime Exposure at Baltimore City Public Elementary Schools*

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Abstract

High levels of school mobility are a problem in many urban districts. Many of these same districts are also dealing with high rates of violent crime. In this study, we use six years (2010-11 to 2015-16) of administrative data from Baltimore City public elementary school students and crime data from the Baltimore Police Department to examine whether changes in violent crime at schools are associated with the likelihood of school exit. Using logistic regression with school fixed-effects to adjust for constant differences between schools, we find that students are more likely to leave following years with higher levels of violent crime at their school. These associations are strongest for students ineligible for free- or reduced-price meals and from safer neighborhoods.

Turnover and student mobility are challenges facing many large districts in urban areas (Miller & Sadowski, 2017; Rumberger, 2016; Welsh 2017). Frequent student mobility can make it difficult to properly sequence material and build the trust necessary for learning (Beatty, 2010; Beck, 1997; Bryk et al., 2010; Grigg, 2012; Hartman, 2002; Fiel, Haskins, & Turley, 2013). As a result, high turnover rates negatively impact both mobile and non-mobile students (Raudenbush, Jean & Art, 2011; Whitesell, Stiefel, & Schwartz, 2016). Understanding why students change schools and what, if anything, schools can do to reduce mobility is essential for providing high-quality instruction for all students.

Most of the research on the sources of student mobility focuses on individual hardship and academic fit (Pribesh & Downey, 1999; Hanushek, Kain, & Rivkin, 2004). However, parents frequently describe school safety as a primary concern in enrollment decisions, and many of the same districts that experience high student mobility are also are plagued by high levels of violent crime (Casella, 2001; Condliffe, Boyd & DeLuca, 2015; Krivo et al., 2018; Papachristos, Brazil, & Cheng 2018). To date, higher rates of residential and school instability among populations exposed to high levels of violent crime have been noted, but not examined in detail (Alexander, Entwisle, & Dauber, 1996; Chen, 2008; Kerbow, 1996). Documenting that exposure to violence has an independent effect on school mobility is important for understanding both the sources of student mobility and what schools and districts could do to reduce student turnover.

In this study, we use six years (2010-11 to 2015-16) of administrative enrollment data from Baltimore City Public Schools (BCPS) and incident-level crime data from the Baltimore Police Department (BPD) to test whether changes in the violent crime rate at a school are associated with an increase in the likelihood of changing schools. Using logistic regression with school fixed-effects that adjust for constant differences between schools, we find that students

are more likely to transfer following years with higher violent crime levels at their school. These associations are strongest for students who are ineligible for free and reduced-price meals (FRM) and students living in safer neighborhoods.

These findings have important implications for our understanding of the challenges facing many urban districts. First, they add to our appreciation of the collateral consequences of urban violence and document that the direct effects of trauma on stress and cognitive functioning are only the tip of the iceberg. Changing schools is stressful under the best of circumstances (Grigg, 2012) and when motivated by safety concerns might be even more difficult for students. Second, our findings add nuance to the limited research on the reasons why students change schools. Rather than moving for reasons related to individual hardship or improved academic fit, our findings suggest that some students move in response to safety concerns at their current school. In other words, even mobility which may not appear strategic by traditional metrics of school academic quality may be a purposeful response to other metrics of quality, such as exposure to violent crime. Finally, the findings highlight one source of the instability and churning that plagues many urban districts and underscore how difficult it is for schools to function in an urban environment where many students and families are exposed to frequent violence.

Background

Why Change Schools?

School changes can be divided into two broad categories: structural and nonstructural moves (Welsh, 2017). Structural moves are required by the organization of the district. For example, in many districts, students must change schools when moving from elementary to middle school and middle to high school. Structural moves also occur when the district

restructures by closing a school or changing grade configurations. These moves are not made by individual students and are involuntary. While these moves may still disrupt a students' social and academic environment, they are not considered the most disruptive kind of moves. Districts, schools, parents, and children are prepared for them to happen, often years in advance, and large numbers of students make the moves together (Grigg, 2014).

Nonstructural moves, on the other hand, occur when a student makes a transfer that is not required by the organization of the district. These students could have at least in theory stayed at their previous school and they are often making the move on their own rather than with a cohort of classmates. It is nonstructural moves that attract the most attention from researchers due to their potential negative effects on individual student achievement and as the source of hard-to-manage classroom instability (Raudenbush, Jean, & Art, 2011; South, Haynie, & Bose, 2007; Whitesell, Stiefel, & Schwartz, 2016).

[Table 1 about here]

The literature on the sources of nonstructural school mobility can be further divided between two overlapping categories of moves: reactive vs strategic and school-related vs non-school-related (Rumberger et al., 1999; Welsh, 2017; See Table 1). *Non-school-related* moves take place due to family-specific changes that are not directly linked to a student's experience at school. These changes often occur simultaneously with a residential move to a new catchment area that forces or enables the student to change schools. Non-school-related moves can either be *strategic*, purposeful, and planned in order to improve the family's circumstances, such as a new job or upgrading to a more desirable home or neighborhood, or an unplanned *reaction* to negative shocks, such as foreclosure, eviction, divorce, or job loss (i.e. Comey and Grosz, 2011; Desmond, 2016). Reactive, non-school related transfers are often associated with lower

achievement scores (Temple & Reynolds, 2000) and higher dropout rates (Gasper, DeLuca, & Estacion, 2012; Rumberger and Larson, 1998), but Pribesh and Downey (1999) argue that the co-occurrence of stressful events affecting children's home and family environments accounts for much of the negative effect of this kind of school mobility on academic outcomes. While the root cause of non-school-related mobility cannot be controlled by the school or district, there are policies that can limit student instability due to these factors. The McKinney-Vento Act, for example, allows students who become homeless to remain enrolled in their current school and even provides transportation to help them do so (Fantuzzo et al., 2012; U.S. Department of Education, 2016).

On the other hand, some moves are made based on school characteristics, not family circumstances. These moves can also be thought of as either reactive or strategic. In the Tiebout model of urban sorting (Tiebout, 1956), *strategic school-related* moves are made purposefully by students and parents to attain a preferred school placement. The presumed increase in academic quality and fit with student needs may explain why some moves result in improved academic outcomes (Hanushek, Kain, & Rivkin, 2004). *Reactive school-related* moves often stem from disciplinary problems. Students with behavior problems may be formally expelled or counselled out of their current school (Losen & Martinez, 2013). These moves are precipitated by things that happen at school, not at home, but are involuntary and unplanned (see Table 1).

Unlike most other sources of mobility, it is not immediately clear whether we should think of moves related to school violent crime as strictly reactive or strategic. On the one hand, families who change schools after an increase in violent crime at a school are clearly reacting to unexpected circumstances. On the other hand, they are making a strategic, voluntary decision to improve the perceived quality of their child's school. They are just trying to improve school

safety and not necessarily academics. Therefore, we argue that safety-related moves should be thought of as strategic reactions: students who change schools due to safety concerns are both “reacting” to their experience at the school and acting “strategically” to avoid perceived danger. This type of move is not involuntary or only due to intense social or economic stress. Instead it is another reason that families intentionally seek out better learning environments for their children.

School Safety and Violence

Research shows that school safety and exposure to violence are associated with parental and student satisfaction. In interviews, parents express a strong desire to limit children’s exposure to violence in their school environment (Condliffe, Boyd & DeLuca, 2015; Lindle, 2008). Especially in urban school districts, families report that safety is a key factor they consider in their school enrollment decisions (Goldring & Hausman, 1999; Kleitz et al., 2000). For example, Bulman (2004) finds that families are more likely to identify schools as “good” schools when they perceive them as less violent. Student absenteeism and dropout are more likely in schools that students perceive as violent and unsafe (Brookmeyer, Fanti, & Henrich, 2006; Kearney, 2008). School safety is also often mentioned as a potential school-related reason for transferring (Kerbow, 1996; Rumberger, 2015; U.S. Government Accountability Office, 2010) and students are less likely to attend school and more likely to transfer to a new one after being victims or witnesses of violence (Akiba, 2008; Benbenishty & Astor, 2005; Carson, Esbensen, & Taylor 2013; Dake, Price, & Telljohann, 2003; Swahn & Bossarte, 2006).

However, these associations do not necessarily mean that students are willing to change schools due to changes in reported crime at their school. First, it is not clear whether safety concerns influence transfer rates after initial enrollments have been taken into account. Families may value safety and choose to enroll only in a school they consider safe, but whether changes in

violent crime at a school would be enough to induce a school transfer has yet to be determined. Second, exposure to school violence is not equally distributed across the population and is highly correlated with other types of disadvantage that can lead to school mobility (Burdick-Will, 2013). Adjusting for the influence of other individual- and school-related factors is necessary to show that students are responding to the crime at or around their school.

Hypotheses

The distinction between the broad types of mobility outlined above and the ways that individuals respond to safety concerns can help generate specific hypotheses about who and when we might expect the strongest effects of school violence on student mobility.

Hypothesis 1: Increases in a school's violent crime rates will predict increases in the probability of a summer school transfer.

Interviews with residents of violent neighborhoods suggest that a shift in personal narrative is needed for someone to change their sense of safety enough to consider leaving (Rosen, 2017; Small, 2004). Therefore, we expect that fluctuations in the violent crime rate at a school will generate mobility. If a school with a high, but stable violent crime rate has a high mobility rate, it is more likely due to non-school-related difficulties in the student population than reactions to perceived safety. Moreover, if we consider safety-related moves to be largely strategic, we should expect to see these kinds of transfers take place during the summer months when they are less academically disruptive (Welsh, 2017). Some midyear moves may also be a result of exposure to school violence, but there will also be parents who are willing to wait until the change can be made in the least disruptive way possible.

Hypothesis 2: The relationship between school violent crime and school transfer will be stronger for students who do not receive free or reduced priced meals.

If we consider moves driven by school violent crime to be strategic, we would expect they are also more likely to take place in families with more social and economic resources. Families must not only want to change schools, but must be able to select and enroll in an alternative that they expect to be an improvement. This does not mean that lower income families are not aware of or worried by violent crime at school, but that they may feel less empowered or able to take concrete action in response (see Pattillo, 2015; Schilbach, Schofield, & Mullainathan, 2016). If, on the other hand, we find that students with fewer economic resources are actually more likely to respond, this would suggest that we may be picking up on unmeasured stressors that confound the relationship.

Hypothesis 3: The relationship between school violent crime and school transfer will be stronger for students from neighborhoods with lower violent crime rates.

Students may view the same incident differently depending on their relationship to those involved or their prior exposure to violence. In other words, a single event in a relatively safe place can lead to substantial changes in perceived safety, but it may take larger changes to shift perceptions when students or residents are used to violence. Similarly, we expect that students who live in more violent neighborhoods will be less likely to respond to school violence by transferring. First, students who live in violent neighborhoods are likely to have lower levels of the social and economic resources needed to navigate a school transfer. Second, they and their families are likely to be somewhat desensitized to local violence and have developed coping strategies to keep themselves safe (Harding, 2010; Rosen, 2017; Sharkey, 2006).

Baltimore Context

Data for this analysis come from elementary school students in the city of Baltimore. This is a good place to study the relationship between school violent crime and student mobility

for three important reasons. First, BCPS has had a high student mobility rate for decades (Alexander, Entwisle, & Dauber, 1996). Student mobility rates at the elementary, middle, and high school levels were between 20 and 25 percent for the 2015-16 school year with significant variation in student mobility across schools and neighborhoods in Baltimore City (MSDE, 2017). These mobility rates are comparable to many other high-poverty urban districts (De La Torre & Gwynne, 2009; Fantuzzo et al., 2012; Metzger, Fowler, & Swanstrom, 2018; Raudenbush, Jean, & Art, 2011; Schwartz, Stiefel, & Chalico, 2009; Welsh, Duque, & McEachin, 2016).

Second, Baltimore has a high and variable violent crime rate. Not only do crime rates vary dramatically across neighborhoods, but there is substantial variability in those rates from year to year (see Morgan & Pally, 2016). This means that students experience enough exposure to violent crime at school to detect its relationship with mobility and to compare schools to themselves over time. High rates of violent crime are not unique to this city. In 2017, Baltimore ranked third nationwide in terms of its total violent crime rate per 100,000 residents, comparable to St. Louis, Detroit, Memphis, Kansas City, Milwaukee, and Cleveland (FBI, 2019).

Finally, Baltimore has a high out-of-zone attendance rate. While all traditional public elementary schools have residentially-based catchment areas, not all students who attend those schools live in those catchment areas. In the 2016-17 school year, the district estimates that 44 percent of students did not attend their local public elementary school. Only a small fraction of this is due to charter enrollment: 34 percent of students attending traditional public schools live outside of the catchment area (BCPS, 2018). This flexibility in enrollment means that elementary students in Baltimore can use residential moves to secure a place in their desired school, but they also have the opportunity to change schools without making costly and time-consuming residential moves. These out-of-zone enrollment patterns are not unique to Baltimore. Many

other districts across the country experience high rates of non-residential enrollment (Burdick-Will, 2017, 2018; Lutton, 2014; Thedos, Couton, & Budde, 2014; Mikulecky, 2012). Perhaps this is why nationally only around one half of school moves involve a residential move (Gaspar, DeLuca, & Estacion, 2010).

There are some downsides to basing the analysis in Baltimore. Given the racial and demographic composition of the public schools (80 percent black, 89 percent free or reduced-price meals) it is difficult to detect variation in these effects by race or assess how wealthy, suburban families might respond to changes in school violent crime. This is common for this type of high-poverty urban district, and similar demographics are found in New Orleans, Washington DC, and Chicago (CPS, 2019; DCPS, 2019; OPBS, 2019). Moreover, even in districts with higher numbers of advantaged, white students, they are rarely exposed to high enough levels of violent crime for an adequate comparison across race (See Sampson, Raudenbush, & Sharkey [2008] for a similar discussion of exposure to neighborhood concentrated disadvantage).

In sum, Baltimore is not generalizable to the entire United States, but it is typical of a large number of high-poverty public school districts in both large cities and increasingly suburban areas. (For more on a classification of urban districts facing similar issues see Milner [2012] and Welsh & Swain [2020]). Understanding the relationship between school violent crime and student mobility in Baltimore can therefore shed light on the sources of student instability and churning in other similar places.

Data

Data for this study come from de-identified BCPS administrative records from the 2010-11 through 2015-16 school years that are stored at the Baltimore Education Research

Consortium. The records include the date of enrollment and withdrawal for each school attended by every student in the district. Each row of the enrollment records include gender, race/ethnicity, grade level, free and reduced-price meal (FRM) status, special education status, and English language learner (ELL) status during that time frame. Our outcome of interest is whether a student changed schools during the summer after the completion of the school year.¹

We use district discipline records to create two measures of student behavior problems that could confound the relationship between school violence and transfer: the number of unique suspensions and the total number of days suspended for each student each year. Students who are disruptive may both contribute to violent incidents at school and be asked to leave due to their behavior.

Residential address changes suggest non-school-related reasons for a school transfer. We, therefore, compare residential addresses recorded by the district at the end of each school year to create an indicator of students' residential mobility during the prior calendar year. Since prior school mobility is also an indicator of instability at home, we include an indicator for whether the student changed schools in the previous summer. We also create an indicator for whether the student lives in the same tract as their school. This provides a proxy for out-of-zone enrollment as well as a sense of how familiar the family might be with the area around the school.

School-level data is collected from the National Center for Education Statistics (NCES) Common Core of Data (NCES, 2017) and the MSDE School Report Cards (MSDE, 2017). We use the geocoded school addresses reported in the NCES data to identify the city block in which each school is located. We use annual standardized test score proficiency rates reported by MSDE to create a rough measure of school quality. In 2014-15, Maryland adopted the Common Core-aligned test (the Partnership for Assessment of Readiness for College and Careers

[PARCC]) and pass rates on standardized tests were lower than in previous years. To account for this discrepancy, we measure school-level achievement by ranking schools by percentile within years according to their average test scores rather than comparing raw test scores. Relative differences in test performance across schools are therefore comparable to other years in the dataset. School-level racial composition and proportion of special education students, ELL, and FRM recipients and mobility metrics, such as the number of new students in each year and the number of midyear exits, are calculated by aggregating the individual-level data to the school level.

Crime data for this study come from incident reports of victim-based crimes published by the BPD on the OpenBaltimore Data Portal for 2010 through 2016 (BPD, 2017). This dataset includes the date, time, location code, and description of all officially reported incidents during this time period. Violent crimes include all assaults, robberies, rapes, shootings, and homicides. We create two measures of violent crime exposure for every student. First, we measure violent crime exposure at school. In order to identify crimes that likely took place at school, we include all crimes that occur on either side of all streets that define each school's city block. These crimes either took place on school grounds or they took place just outside of school, on the street that runs along the school grounds. Either way, police presence would have been visible from the school itself. The idea here is not to explore whether the neighborhood surrounding the school is safe, but whether the immediate location of the school is safe. There is wide variation from block-to-block in violent crime rates (see Braga, Papachristos, & Hureau, 2010) and even in generally violent neighborhoods the immediate area of the school may be quite safe, or vice versa. We include only violent crimes that occur during the day (6:00am to 7:00pm) on weekdays between the first and last days of school. These are crimes that students and their

families are most likely to be aware of and to which students are most likely to be exposed. This time period is long enough that we can reasonably assume there were some students in the vicinity of the school, even if just for a one-time event, but not so short that it removes all variation in students' exposure.

Our second measure of violent crime captures students' exposure in their home neighborhood. Here we count all violent crimes that take place in each students' residential census tract at any time of day and any day of the week during the full calendar year, from the first day of school to the start of the next school year. High levels of out-of-zone enrollment and the highly spatially concentrated nature of violent crime mean that students' exposure to violent crime at school and in their residential neighborhoods are not strongly correlated ($r = 0.15$).

Given the skewed distribution of exposure to violent crime, both measures have been transformed using the inverse hyperbolic sine (IHS) function. This transformation is frequently used when modeling wealth and has the benefit of a similar interpretation as the log transformation, but can be used when values include zero (Burbidge, Magee, & Robb, 1988). This means that the coefficients represent approximate percent change in exposure rather than an increase in a specific number of crimes.

One limitation of the administrative data is that it does not include any direct measures of family background. Instead, we rely on student addresses to capture at least some differences in socio-economic circumstances and adjust for other aspects of students' neighborhoods that may be associated with violent crime exposure at school. Specifically, we include tract-level measures of median household income and percent of residents with a bachelor's degree or higher from the 2011-15 American Community Survey. Including additional neighborhood measures, such as the poverty, unemployment, or welfare rates does not add anything to the models.

Analytic Sample

For each focal year, we use the enrollment records for the prior year to create measures of prior residential and school mobility and records for the following year to create our outcome of summer mobility. Therefore, we limit our analysis to the 2011-12 through 2014-15 school years, and we use the first and last years of available data (2010-11 and 2015-16 school years) to calculate mobility indicators for before and after each analytic school year.

Within that timeframe, we limit our analysis to students enrolled in kindergarten through fifth grade. There is substantially more mobility in these lower grades and, although there are generally lower levels of violent crime in the area around elementary schools than around high schools, there is substantial variation in student exposure. We exclude middle and high school students because the magnet programs and open enrollment choice process available in these higher grades makes changing schools more difficult. There are not always seats available at desirable schools and it is often difficult to move to a popular school after the initial assignment has been made. There is substantially less curricular differentiation between elementary schools and there are no selective enrollment or vocational schools at the elementary level that provide a unique experience and would therefore be likely to retain students regardless of local safety concerns.

Students making structural moves because they have reached the highest grade available at their current school are excluded from the analysis. While it is relatively rare in grades K-5, some schools do close or have limited grade offerings. These moves are not voluntary and therefore do not represent an active decision to move on the part of the family (Welsh, 2017).

Finally, we limit our analytic sample to observations in which students are continuously enrolled in a single school for the entire year in order to ensure that all students in a school were

exposed to the same violent crime rate. This also allows us to focus on students with only one enrollment row per academic year. Midyear mobile students contribute to school-level measures, but their individual observations are not included in the analysis.

The use of administrative enrollment records means that every student has a complete record and there are no missing values in our population of stably enrolled students.² Moreover, since we count a student as leaving their school regardless of their destination, leaving the district does not generate any missing values.

Students may change schools or neighborhoods every year. Therefore, the resulting data structure leads to annual observations that are simultaneously cross-classified by student, school, and neighborhood. The analytic timeframe allows for up to four observations per student, however, some students leave the district and others are too young or old to be observed in all four years. In practice, there are only an average of 2.2 observations per student. Since our exposure of interest is at the school-level and we have relatively few observations per student, we treat the data as having two levels: annual observations nested within schools.

Methods

Assessing the relationship between exposure to school violent crime and school mobility is difficult due to the selection of different types of students into different schools. Most importantly, exposure to school violence is correlated with other sources of student disadvantage that lead to school mobility for non-school-related or reactive reasons. In order to adjust for as much of this selection as possible our models include student demographics, neighborhood characteristics, reports of student discipline problems, and indicators of prior residential and school mobility. Adjusting for residential mobility during the school year removes confounding by non-school-related factors that influence housing, such as foreclosure, foster care, or divorce.

Prior summer school transfers capture unmeasured sources of family instability that could also lead to a non-school-related transfer. Individual suspension records allow us to adjust for involuntary school-related moves that are related to formal expulsion or informal counseling out.

In addition to bias from individual selection, our models must also account for school-level characteristics that correlate with school violence but are an independent source of student instability. Therefore, we adjust for time-varying measures of school size, demographics, special program use, and mid-year mobility. School fixed-effects adjusts for unobserved, constant differences between schools that might be related to both safety and mobility, such as proximity to transit and commercial areas (Cohen & Felson, 1979) or structural features of the school building that limit adult supervision (Sánchez-Jankowski, 2016). With these fixed effects in the model, the coefficient for the school violent crime represents the estimated relationship between mobility and year-to-year changes in school violent crime. In other words, they allow us to compare students in the same school but different calendar years to see if students are more likely to leave in years with higher violent crime rates. The school fixed effects also account for the nesting of observations within schools by calculating robust, clustered standard errors.³

The formal model is as follows:

$$\log ((P(Y_{ijk}=1)/(1- P(Y_{ijk}=1)))) = \eta_{ijk} \quad (1)$$

$$\eta_{ijk} = \beta_0 + \beta_1 V_{tj} + \beta_2 X_{ti} + \beta_3 M_{ti} + \beta_4 N_{tik} + \beta_5 S_{tj} + d_t + s_j + \varepsilon_{ijk}$$

Where Y_{ijk} is an indicator for whether or not student i living in neighborhood k made a non-promotional exit from school j in the summer following school year t ; V_{tj} is the IHS-transformed measure of violent crime at school j in year t ; X_{ti} are the individual-level characteristics of student i during school year t (including gender, race/ethnicity, special education status, English Language Learner status, FRM, grade-level, living in the school tract, number of suspensions,

and total days suspended); M_{ti} are additional mobility indicators for student i during year t , including whether the student changed addresses in the prior calendar year or changed schools last summer; N_{tik} are the characteristics of the student i 's census tract k in during year t , including the IHS-transformed violent crime count, median household income, and percent of residents with a bachelor's degree or higher; S_{ij} are time-varying characteristics of school j in year t , including total enrollment, total number of student entries and exits during the school year, and percentages of students who are identified as black, Hispanic, ELL, FRM, and special education eligible; d_t are dummy variables for each school year; s_j are fixed-effects for each school; and ε_{ijk} are the observation-level error terms. All standard errors are robust and clustered at the school level.⁴

Results

Descriptive Summary

Table 2 reports the distribution of the types of crimes that occur at Baltimore City elementary schools during the 2010-11 through 2014-15 school years. In the average school year there are around 7 reported assaults and 1 robbery, leading to a total of approximately 8 violent crimes. However, these distributions are skewed with a few schools reporting more than 50 violent crimes in a single school year. Most schools do not have any of the most serious reported crime types, but there are a few schools that have up to 3 homicides and 2 rapes or shootings in one school year.

[Table 2 about here]

Table 3 describes the analytic sample and compares it to students who are excluded from the analysis due to mid-year mobility. Around 13 percent of all observations and 12 percent of stable enrollments result in a summer move. Mid-year moves are slightly less common. Only

around 10 percent of all observations are excluded due to a midyear move. As expected, midyear movers are generally more mobile by other measures as well. They are substantially more likely than stably enrolled students to have changed residences in the last year and to change schools during the previous or following summers. They are slightly more likely to be black and are more disadvantaged than the rest of the population in terms of special education, English language learning, free and reduced-price meals, behavior problems, tract demographics, and violent crime exposure in both their neighborhoods and schools, but these differences are relatively small. The number of students in the stable and midyear-mobile groups does not add up to the total number of students because some students are mobile in some years and stable in others.

[Table 3 about here]

Table 4 presents school characteristics in years with low, medium, and high levels of school violent crime. School-years in the bottom third of violent crime (fewer than 3 reported crimes) are considered low, schools in the top third of average violent crime (more than 8 reported crimes) are considered high, and all other schools fall in the medium category. Exposure to violent crime is somewhat associated with school size, with highest-exposure school-years enrolling approximately 48 students more than the lowest-exposure schools on average. The biggest differences between high and low violent crime school years is reflected in their racial composition. More than 90 percent of the students in the high violent crime school years are black, compared to 75 percent in the low violent crime years. Only 5.5 percent and 2.7 percent of students in high violent crime school years are white or Hispanic, respectively. These numbers show that while not all students in predominantly black schools in Baltimore are exposed to violent crime, those who are exposed are much more likely to be black. Schools in the highest-

exposure category also serve disadvantaged students in terms of FRM and special education, although they serve fewer ELL students than schools in the other two exposure categories. Test scores are also somewhat lower in the highest exposure years. Higher violent crime school years also have somewhat higher turnover rates with larger numbers of new students (123 in the lowest violent crime years versus 152 in the highest) and midyear movers (34 versus 53). The last row of the table shows how many schools are represented in each of these groups. The numbers in each column do not sum to the total because many schools change categories from year to year.

[Table 4 about here]

Figure 1 shows the geographic distribution of school violent crimes across Baltimore for the 2013-14 academic year. Tract-level violent crime is shown in the background as a reference. The schools with no reported violent crimes are marked in gray. Larger black circles represent schools with larger numbers of reported violent crime. Two characteristics of the spatial distribution of school violence are worth highlighting. First, while the most violent schools are generally closer to more violent neighborhoods, there are quite a few reported school crimes in what otherwise appear to be relatively safe areas of the city and very safe schools in otherwise dangerous neighborhoods. For example, Eutaw-Marshburn Elementary School did not experience a single violent crime in the 2013-14 school year, but 134 violent crimes were reported in the surrounding tract during the same period. Second, schools that are very close to one another geographically can have dramatically different violent crime rates. For example, Empowerment Academy is located across the street from Calverton Elementary. During the 2013-14 school year, there were 17 violent crimes reported at Calverton, but none at Empowerment. This spatial variability is due to the highly concentrated nature of violent crime. Even in the most dangerous neighborhoods in Baltimore and elsewhere, most crimes take place

on a relatively small number of specific block faces (Braga, Papachristos, & Hureau, 2010; Cohen & Felson, 1979; St. Jean 2008).

[Figure 1 about here]

There is also quite a bit of temporal variability from year to year, especially in schools on the higher end of the violent crime distribution. Figure 2 illustrates the violent crime rate for 12 randomly selected schools over time.⁵ Violent crime rates in some of these schools vary dramatically from year to year, with the most violent school-year in this figure peaking near 60 incidents but dropping below 20 in other years. Even in the lowest crime schools there is variability. In fact, only one elementary school in the city (a charter school in the northwest part of the city) reported no violent crimes in any year.

[Figure 2 about here]

Regression Results

Table 5 presents results for the logistic regressions of student mobility on school violent crime. Coefficients are reported in odds ratios. Model 1 includes only student-level covariates. Unsurprisingly, the largest predictor of school mobility is prior residential mobility. The odds of school mobility for students with an address change in the prior calendar year are 8.6 times higher than those who did not change addresses. The odds that students who changed schools during the previous summer move again are 24 percent greater than those who enrolled in the same school as last year. On average, black students are more likely to change schools than non-black and non-Hispanic students. Hispanic and ELL students are less likely to change schools. In this model, the number of unique suspensions does not predict school mobility, but each additional day suspended increases the odds of changing schools by one percent. With all of the student- and school-level adjustments, percent of residents with a bachelor's degree in the

student's tract does not predict school mobility, but one standard deviation increase in median household income predicts a six percent reduction in the odds of changing schools and living in the same neighborhood as the school reduces the odds of changing schools by 12 percent.

When violent crime in students' neighborhoods doubles, the model predicts a five percent decrease in the odds of school transfer. The negative relationship between neighborhood violence and school mobility may come as a surprise since neighborhood violence tends to be positively associated with residential instability. However, since baseline tract violent crime rates are much higher than school violent crime rates (108 on average), it is much more difficult for these crime rates to double in a single year and the magnitude of this effect is quite small. Moreover, since many students do not attend school near their home neighborhood, residential tract violent crime is unrelated to violence exposure or perceptions of safety at school. Instead, this coefficient captures the association between residential violence exposure and student mobility above and beyond the effects of social and economic neighborhood disadvantage, student poverty, residential instability, prior school mobility, and school enrollment that might lead to a reactive move. In other words, the direction of the relationship suggests that after adjusting for all of these factors, high rates of violence near home may impede families' available bandwidth to engage in a strategic, voluntary school transfer process for any reason (Schilbach, Schofield, & Mullainathan, 2016). Alternatively, when families experience high rates of neighborhood violence they may seek out more stability in their school environments as a counterbalance to disadvantage at home (Crosby et al., 2019).

With the IHS transformation, the coefficient for school violent crime represents predicted change in the odds of mobility when violent crime rates at a school double (one hundred percent change). Since school violent crime rates are relatively low, in many cases the rate could double

with just a few additional crimes. In this first model, when adjusting for student characteristics, doubling the school violent crime rate increases the odds of a student leaving the school by 14 percent.

[Table 5 about here]

Model 2 adds observed school characteristics. Students are more likely to leave schools with higher midyear mobility rates, lower test scores, and higher proportions of black, ELL, and FRM students. Including these covariates reduces the magnitude of the school violence coefficient. Now a doubling of school violent crime predicts a four percent increase in the odds of school transfer.

The next model (Model 3) adds school fixed-effects to account for any unobserved, constant differences between schools that might be related to both mobility and violent crime. Interestingly, the coefficient for school violent crime remains essentially the same as the previous model: when school violent crime doubles, the school fixed-effects model again predicts a four percent increase in the odds of school mobility. Converting the odds ratios to predicted probabilities means that, holding all else constant, the predicted probability of a student with average characteristics transferring from a school with no violent crimes is 11.4 percent, with average violent crime exposure (8 violent crimes in a year) is 12.4 percent, and with exposure one standard deviation above the mean (17 violent crimes in a year) is 12.7 percent. This means that approximately 5.8 additional students are expected to leave an average-sized school (approx. 443 students) after a high violent crime year than a year with no reported violent crimes.

Interactions

There is no evidence of differential associations by grade, race, gender, English language learner, special education status, prior mobility indicators, living near the school, or school proficiency levels (results not shown in tables). However, there is evidence that the relationship between violent crime exposure and school transfer is stronger for more advantaged students who are more likely to have the resources to make a strategic move (hypothesis 2). Model 4 shows the interaction between exposure to violent crime near school and FRM status. Non-FRM eligible students are much more likely to leave their school following a year with relatively high violent crime. For non-FRM students, doubling school violent crime predicts an 11 percent increase in the odds of transfer, while for FRM students the same increase in school violent crime only predicts a three percent increase in the odds of transfer.

The relationship between school violence and mobility also varies by exposure to neighborhood violence: students from safer neighborhoods are more sensitive to exposure to violence at school (Model 5, hypothesis 3). This is true whether or not we include the FRM interactions. In the most extreme case, students in neighborhoods with zero reported violent crime are expected to increase their odds of school transfer by 31 percent when school violent crime doubles. However, there are very few students who actually live in such safe neighborhoods. More realistically, for students who live in the safest decile of neighborhoods (with fewer than 27 violent crimes in a year), doubling school violent crime predicts an 11 percent increase in the odds of changing schools. In neighborhoods with average violent crime rates (approximately 100 violent crimes per year), doubling school violence only predicts a five percent increase in the odds of changing schools. For students in the most violent neighborhoods (approximately 250 crimes per year), it drops to a less than two percent increase in the odds of

mobility. This suggests that students who are exposed to violence near their homes are desensitized to exposure at school.

Robustness Checks

Despite the rigorous adjustments for potential confounding, it is still possible that our models are not capturing the true relationship between school violent crime exposure and summer mobility. Below we describe three different robustness checks used to examine potential bias in our measures and estimates. First, our measure of school violence relies on the fact that crimes which take place on school grounds need to be reported with addresses on the streets that surround the school campus. To test whether these crimes are just capturing the general area around the school and not what is going on inside the grounds, we also created measures of violent crime in the census tract in which the school is located and within a half-mile buffer of the school. The correlation between these measures and the crime rates at school is relatively low (0.27 and 0.16 respectively) and these measures do not significantly predict student mobility (results not shown). This suggests that families are responding to—and our school violent crime measure is capturing—something about the school itself rather than the larger area around the school. One potential explanation for this difference is that general safety in the area is likely already taken into account when selecting the school and, therefore, is less likely to influence subsequent student mobility decisions.

Second, individual-level standardized test scores are only available for students in the third grade or higher. In order to include as many elementary school students as possible we do not include measures of individual achievement in the main models. However, analysis using only students in grades 3-5 and including test scores shows that test scores are not predictive of mobility after adjusting for the other covariates ($\beta = 1.03$, s.e. = 0.02) and the coefficients for

exposure to violence are essentially the same with or without the controls for achievement ($\beta = 1.06$, s.e. = 0.03). This suggests that our results are not biased by excluding achievement scores in the main models.

Finally, despite the rigorous school- and student-level adjustments, it is possible that unobserved differences between students account for some of the association between school violent crime and student mobility. One way to assess whether there are still unobserved differences between schools and students that drive the association between school violent crime and mobility is with placebo tests. First, we use a measure of violent crime that took place at the school in the year *after* observed student mobility. If there is something about the school or student that is generating bias in our estimate, we might expect that this “future crime” measure would also be as strongly related to the likelihood of school mobility as our main measure. On the other hand, if timing matters and this “future crime” measure has a weaker relationship with prior mobility, it is more evidence that our estimates are not driven entirely by bias. The results of this placebo test are clear: measures of school violent crime in the following year are half the size of the main coefficients and not precisely related to student mobility ($\beta = 1.02$, s.e. = 0.02). Second, we exploit the timing of the school day to test whether violent crimes that take place at night, when students are not on campus, have the same relationship with mobility. If they do, it is a sign that there is unmeasured confounding. Again, the results are clear: nighttime and weekend violent crime have a much weaker and more imprecise relationship with student mobility ($\beta = 1.02$, s.e. = 0.02).

Destinations

One might wonder what kind of schools students exposed to school violence transfer to and whether their school change leads to an improved social or academic environment. To assess

whether leaving schools with high violence levels influences the quality of the receiving school we use our main models, including the sending school fixed-effects to predict the proficiency rates and school violent crime rates of the schools that movers attend. The results indicate that there is no significant relationship between the level of violent crime at a school and the characteristics of destination schools (full results in Online Appendix A). This suggests that students who move for safety reasons are more concerned with leaving a particular environment and are not able to harness that move to improve objective measures of school quality.

Discussion and Conclusion

Student mobility and exposure to violence are both well documented problems in many urban school districts. In this study, we show that these two phenomena should not be considered in isolation and are in fact related. Specifically, we show that in academic years with higher levels of reported violent crime at school, students are more likely to transfer from that school at the end of the year, even after adjusting for a large number of student, school, and neighborhood characteristics. For the average student, when school violent crime doubles, we predict an approximately four percent increase in the odds of school transfer. Moreover, these predicted associations are substantially larger for students who do not qualify for free- and reduced-price meals and for those from safer neighborhoods. For these students, doubling violent crime predicts an 11 percent increase in the odds of school mobility. This suggests that it is relatively more advantaged students who are most sensitive and able to respond to changes in violence at their school. Therefore, school violent crime may not only influence individual students' transfer rates, but may also shape the composition of the student body by pushing out some of the most advantaged students. Alternatively, exiting students may be replaced by new students with similar demographics who are leaving their own schools for any number of reasons. Longer time

frames with more statistical power than are available in this study are needed to test this school-level hypothesis directly.

Doubling a violent crime rate may seem like a high benchmark for the marginal effect, but since school violent crime rates are generally low, this is actually quite common. Remember that it takes just one additional crime to double the rate from 1 to 2. Of the 352 school-years where it is possible to calculate the change from one year to the next, around 23 percent of school-years experienced a change from one year to the next of at least 100 percent, and many reported even larger changes. Given the baseline mobility rates, student populations, and the estimated increase in mobility due to school violence, the average school in the district can expect an additional 1.5 students to transfer per year due to safety concerns, with some excess mobility as high as nine students in some schools in a single year. At the district level, 665 students are estimated to have changed schools during this period due to Baltimore's high levels of school violence. Baltimore's violent crime rates have only increased since the years analyzed in this study (Morgan & Miller, 2020), suggesting that even more students could be changing schools due to safety concerns today.

Any loss of students can have serious financial and existential problems for a school. In an era where losing the competition for students can also lead to closure, principals are in a constant battle to attract and retain students (McWilliams, 2019). With per-pupil spending at approximately \$16,000 (US Census Bureau, 2018), the loss of just a few students can lead to reduced staff and program cuts (Cossyleon & Schock, 2019). Even if new students end up enrolling in the fall, the uncertainty and effort that goes into recruitment can cause organizational problems (Jabbar, 2015). Turnover in the student population can also undermine a school's effort to create a trusting, positive climate for students (Bryk et al., 2010).

It is also important to remember that these models include a large number of covariates, including prior school and residential instability and students' disciplinary records. Controlling for so many possible reasons for student mobility makes it notable that the influence of school violent crime can be detected at all. Most importantly, this study controls for prior school and residential mobility, which are proxies for general family instability and known to be strong predictors of school transfer. While the effect size for school violence exposure does not compare to these individual predictors, it is comparable to the effect of standardized test score proficiency rates in our models. One standard deviation change in these pass rates predicts approximately a 6 percent reduction in the odds of school transfer. This suggests that students are about as sensitive to changes in safety as they are in changes in academics.

Furthermore, this study likely underestimates the total effect of school violent crime on mobility. First, we only measure parents' sense of safety at school indirectly, through reported violent crime. Many fights and disruptive events do not get reported to the police and therefore do not show up in these data. The relationship between objective measures of violence and perceived safety varies across students in the same school (Burdick-Will, 2013; Lacoe, 2016; Steinberg, Allensworth, & Johnson, 2011). What we estimate is likely an effect that is averaged across families who have intimate knowledge of what happened during those events and those who may know little about them. This means that our estimated effects are only capturing the most extreme tip of the iceberg. Were we able to pinpoint more direct exposure to or knowledge of violence at school, we would likely find even larger effects for a subset of students (Carson, Esbensen, & Taylor, 2013).

Second, in order to simplify the analysis and pinpoint the timing of violence exposure and transfer we focus only on summer transfers. Assuming that some proportion of mid-year

movers are also influenced by safety concerns (in fact, safety is one of the only reasons a student can request a non-residential mid-year transfer [BCPS 2020]), the total effect of school violence on student mobility and churn is likely to be much larger. Finally, violent crime in and around schools is not only known to students, but also administrators. Research shows that with the right social and emotional supports, it is possible for a school to make students feel safe regardless of what is going on outside the building (Bryk et al., 2010; Crosby et al., 2019). Doing so is not only likely to lead to lower levels of violence from within the building, but also make families more inclined to stay, since research shows that student transfer rates can be reduced when schools reach out to families to build strong social relationships (Fiel, Haskins, & Lopez Turley, 2013). It is possible that principals are already working to reduce the effect of safety concerns at schools by engaging in strategic retention efforts. Given these realities, it is important that researchers, schools, and districts take even these small estimated effect sizes seriously.

The relationship between exposure to violence and student mobility has important implications for educational theory and policy. First, these findings expand our understanding of the sources of student mobility. The existing literature tends to focus on the relationship between student mobility and personal hardship, and in particular, how residential instability leads to school instability (Comey, Litschwartz, & Pettit, 2012; Cordes, Schwartz, & Steifel, 2019; Hanushek, Rivkin, & Kain, 2004). This focus on reactive, involuntary moves implies that student instability is a reflection of students' home lives and therefore not controlled or influenced by schools or districts. In contrast, we argue that students and their families may be behaving with more agency than this literature gives them credit for, and in response to factors that are in fact school related. In other words, by demonstrating that changes in violent crime near school help to predict student mobility, we provide evidence that student mobility is about more than just

students' own social, economic, or residential instability. Importantly, this means that schools districts could take action to promote a safe learning environment and reduce at least some of that instability.

Second, the results provide even more evidence of the collateral damage of violent crime on urban areas (i.e. Harding, 2010; Sharkey, 2010) and remind us to look beyond individual stress and trauma as a causal mechanism. Strategic school transfer is a form of avoidance for protective purposes. Similar to teachers who leave unsafe schools (Boyd, 2011) and students who stay home rather than brave a dangerous commute (Burdick-Will, Stein, & Grigg, 2019), families likely seek to protect themselves by leaving schools that they no longer feel are safe. This means that the consequences of an unsafe environment ripple across cities and districts in ways that are often underappreciated when we focus only on direct victims or witnesses.

Changing schools is stressful under the best of circumstances (Grigg, 2012). When transfers are motivated by the stress of exposure to violence, they are likely to be even more difficult for students. However, the overall academic effect of these safety-driven moves for individual students is difficult to determine and likely depends on where the movers end up. On average there is no relationship, positive or negative, between leaving a school with high levels of violence and the characteristics of the receiving school. This fits with the existing literature that shows that for most mobile students receiving schools are very similar to sending schools (Welsh, 2017). The lack of improvement may be a sign that the structural constraints that lead students into one type of school are hard to overcome when a student changes schools (Burdick-Will, Grigg, Nerenberg, & Connolly, 2020).

Nevertheless, the average null effect likely hides substantial variability for individual students. As with any strategic transfer, if families use the move to improve their child's social

and academic environment, these moves may result in long-term academic benefits (Hanushek, Kain, & Rivkin, 2004). On the other hand, if a student's enrollment is disrupted without a gain in school quality, the move may be detrimental. Unfortunately, given the year-to-year fluctuations in school violent crime rates, some students may leave one school because they experienced violence for another that they think is safer, only to find that in the next year their new school experiences more violence than they expected. In this case, students might be inclined to move again in the following year, leading to even more instability in their academic trajectories. Further research is needed to unpack the consequences of safety-related school transfers and the tradeoffs that families face when changing schools due to safety concerns.

Understanding the complex and multi-faceted relationship between exposure to violence and academic outcomes is especially important because it is an often hidden disadvantage for black students. Research repeatedly finds that black students are more likely to change schools than white students with similar background characteristics (Welsh, 2017). Our results show that even more advantaged, non-FRM Baltimore public school students of color face substantially higher levels of violent crime exposure than their white peers. These findings suggest that this exposure is a source of instability in these students' lives, leading to school transfers that may not have happened in safer environments. Perhaps just as importantly, the interaction with FRM-eligibility suggests that students with more resources are better able to move in response to school violent crime. This means that large numbers of students without those resources are likely to feel unsafe and want to change schools, but are unable to do so. These students are also at a substantial disadvantage given the negative and cumulative effect of exposure to violence on concentration and learning (Burdick-Will, 2013, 2016; Sharkey et al., 2012).

Finally, the results of this study suggest that to reduce student turnover rates, policy makers in urban districts must think beyond their own walls and consider the larger urban context. Since violent crime reported just outside of the school building can significantly impact families' decisions about school enrollment, districts may be able to reduce student turnover by expanding their definition of school safety. Although many districts have begun to place security guards inside school buildings, schools often ignore the areas just outside or across the street from their buildings (Sánchez-Jankowski, 2016; Steinberg, Allensworth, & Johnson, 2011). More could be done to protect students and provide a safe zone in these border areas. Our results show that this does not mean that a school needs to make the whole neighborhood around the school safe. Instead, focusing on reducing exposure to violent crime on the streets surrounding the school can potentially increase stability in enrollment patterns at the district level.

Instability and churning in urban school systems is a serious problem. Shifting student populations pose an instructional and organizational problem for schools. Not only do individual students tend to do poorly after a school transfer, but schools and classrooms with high mobility rates are harder to teach (Raudenbush, Jean, & Art, 2011; South, Haynie, & Bose, 2007; Whitesell, Stiefel, & Schwartz, 2016). Stability in enrollment and staffing is also necessary for building the trusting and supportive environment necessary for learning (Bryk et al., 2010; Fiel, Haskins, & Turley, 2013; Grigg, 2012). Understanding the sources of instability are key to developing policies to fight it. This study shows that high levels of churning are not just a reflection of student disadvantage, but also of structural and social problems in our cities as a whole. Therefore, devoting resources to improving safety in our cities should be considered not just a good in and of itself, but also a necessary step to improving educational outcomes in large urban districts.

Endnotes

1. We use only summer moves for two reasons. First, by restricting our mobility measure to the summer months we ensure that the timing of the move necessarily comes after the measurement of violent crime during the school year. While there are likely to be some families who change schools mid-year in response to specific violent events, the timing of that decision is difficult to pin point and there are more likely to be unmeasured non-school-related stressors leading students to change school at that time. If we were to count moves that took place earlier in the school year, we might mistakenly attribute the mobility to crimes that had not yet taken place. More than 70 percent of all mid-year mobility takes place during the fall semester making the issue of timing especially difficult for mid-year moves. Spring mobility is too rare to predict with any confidence using fall violent crime exposure. Second, summer moves are considered to be, on average, more strategic and intentional than moves that occur during the school year (Welsh, 2017). By limiting our analysis to these strategic moves, we are more likely to capture parental reactions to something that happened at school rather than reactions to other not-school-related changes in home or family life.
2. Around 4.5 percent of midyear mobile observations, mostly late entry kindergarteners, have addresses that we were not able to geocode, but these observations are not included in the analytic sample as they arrive at the school in the middle of the year.
3. Given the repeated observations within students it would in theory also be possible to include a student fixed-effect to control for constant difference between students. We choose not to do this for three reasons. First, there is simply not enough variation in student mobility rates year to year to include a student fixed-effect. Doing so, would require that we drop all students who never move along with those who move every year and severely restrict our analytic sample.

Second, with such a small number of observations per student (2.2 on average, max of 4), a logistic regression with student fixed effects would certainly suffer from the incidental parameter problem (Lancaster, 2000). Finally, the outcome is a change in school enrollment. Students are most likely to change schools when something else has changed in their lives. Therefore, a student fixed-effect that only controls for constant differences between students is unlikely to remove much of the bias that we would be worried about in this case. For these three reasons we leave out the student fixed-effects, but control for as many constant and time-varying student characteristics as possible. Grouping the observations by school-neighborhood combinations results in cell-sizes that are also too small (17 students on average) to run stable logistic regressions. Using a neighborhood fixed-effect rather than a school fixed-effect would not control for the unobserved differences in school characteristics that we think are more likely to be related to school transfer than unobserved neighborhood characteristics.

4. Given the large number of students enrolled in each school over the four-year period (948 on average), the model does not suffer from the incidental parameter problem. Nevertheless, all models are estimated using xtlogit, fe in STATA which runs conditional logistic regressions that are designed to avoid this type of bias (Chamberlain, 1980).

5. We chose to show 12 schools because it is around 10 percent of the sample and is a large enough number to show a range of schools, but small enough that one can still make out the individual lines in the figure.

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Figure 1: Reported Violent Crimes at Baltimore City Public Elementary Schools and Census Tracts during the 2013-14 School Year

Source: Authors' calculation based on data from the Baltimore City Police Department and the Baltimore City Public Schools.

Figure 2: Trend in School Violent Crime in Randomly Selected Baltimore City Public Elementary Schools (2010-2014 School Years)

Note: Each line represents a single, randomly selected elementary school.

Source: Authors' calculation based on data from the Baltimore City Police Department and the Baltimore City Public Schools.

Table 1: Typology of Non-Structural School Moves

	Non-school related	School-related
Reactive: unexpected, stress-related, involuntary	Student social or economic problems (e.g. foreclosure, divorce, unemployment)	Student behavior problems (i.e. expulsion)
Strategic: planned, purposeful	Student social or economic improvements (e.g. new job, new house)	Better academic fit Improved safety

Table 2. Violent Crimes at Baltimore City Elementary Schools Per Academic Year (2010-11 through 2014-15)

	Mean	Standard deviation	Median	Minimum	Maximum
Violent	7.93	9.00	5	0	56
Assault	6.63	7.53	4	0	52
Robbery	1.11	2.14	0	0	19
Rape	0.06	0.25	0	0	2
Shooting	0.07	0.28	0	0	2
Homicide	0.06	0.30	0	0	3

Source: Authors' calculation based on data from the Baltimore City Police Department and the Baltimore City Public Schools.

Table 3: Student Characteristics by Enrollment Status

	Stable	Midyear Move	All
Midyear School Move	0 (0)	100 (0)	10.05 (30.07)
Summer School Move	12.31 (32.86)	19.77 (39.82)	13.06 (33.70)
School Move Last Summer	15.83 (36.50)	25.58 (43.63)	16.81 (37.40)
Residential Move	30.02 (45.83)	62.47 (48.42)	33.28 (47.12)
Male	51.26 (49.98)	52.76 (49.93)	51.41 (49.98)
Black	80.36 (39.73)	83.86 (36.79)	80.71 (39.46)
Hispanic	8.32 (27.62)	7.42 (26.21)	8.23 (27.49)
Special Education	11.86 (32.34)	13.73 (34.42)	12.05 (32.56)
English Language Learner	4.74 (21.26)	6.21 (24.14)	4.90 (21.58)
Free and Reduced-Price Meals	88.92 (31.39)	92.64 (26.12)	89.30 (30.92)
Number of Suspensions	0.07 (0.06)	0.13 (0.84)	0.08 (0.627)
Days Suspended	0.24 (3.12)	0.59 (5.21)	0.27 (3.39)
Grade	2.22 (1.61)	1.97 (1.61)	2.19 (1.61)
Tract Median Household Income	39477.0 (17989.3)	36497.3 (14942.6)	39177.4 (17729.3)
Tract Percent with Bachelor's Degree	19.58 (16.42)	16.79 (13.91)	19.30 (16.21)
Live in School Tract	34.12 (47.41)	36.82 (48.23)	34.39 (47.50)
Tract Violent Crime	107.5 (55.94)	113.5 (56.21)	108.1 (56.00)
Violent Crime at School	8.04 (9.17)	8.80 (9.42)	8.12 (9.21)
Observations	122,245	13,666	135,911
Students	54,235	11,958	60,971

Note: Percent for dichotomous variables and mean for continuous variables. Standard deviation in parentheses.

Source: Authors' calculation based on data from the Baltimore City Police Department and the Baltimore City Public Schools.

Table 4: School Characteristics by Thirds of School Violent Crime

	Low	Medium	High	All
Total Enrollment	423.4 (203.7)	440.4 (208.7)	470.4 (174.5)	443.2 (197.6)
Number of New Students	122.6 (72.13)	136.3 (68.64)	152.0 (59.95)	136.0 (68.43)
Number of Midyear Exits	33.80 (19.32)	44.42 (22.51)	52.80 (23.77)	43.00 (23.12)
Proficiency Percentile	66.58 (24.58)	53.58 (25.67)	47.45 (25.55)	56.57 (26.45)
Percent Black	75.36 (28.77)	82.99 (22.35)	90.38 (16.48)	82.39 (24.26)
Percent Hispanic	9.224 (16.39)	7.643 (14.32)	2.779 (4.152)	6.756 (13.36)
Percent English Language Learner	5.302 (10.32)	4.405 (9.570)	1.644 (3.869)	3.901 (8.715)
Percent Special Education	11.97 (3.752)	12.55 (4.074)	13.93 (3.528)	12.75 (3.873)
Percent Free and Reduced-Price Meals	84.72 (16.25)	89.11 (14.25)	94.20 (6.875)	89.02 (13.89)
School Violent Crimes	1.56 (1.04)	5.77 (1.47)	18.06 (10.29)	7.93 (9.0)
Number of School-Years	188	163	153	504
Number of Schools	79	82	65	129

Note: Standard deviations in parenthesis. Low violent crime school years have fewer than 3 reported violent crimes. High violent crime years have more than 8 reported violent crimes. Medium violent crime school years are those in between. The number of schools in each category does not add up to the total number of schools because schools may be counted in multiple groups depending on the violent crime count in each year.

Source: Authors' calculation based on data from the Baltimore City Police Department and the Baltimore City Public Schools.

Table 5: Predicted Odd Ratio of Student Mobility

	Model 1	Model 2	Model 3	Model 4	Model 5
School Violent Crime	1.14*** (0.01)	1.04** (0.01)	1.04* (0.02)	1.11** (0.04)	1.30** (0.12)
Male	1.07** (0.02)	1.06** (0.02)	1.06** (0.02)	1.06** (0.02)	1.06** (0.02)
Black	1.68*** (0.07)	1.17** (0.06)	1.15** (0.05)	1.15** (0.05)	1.15** (0.05)
Hispanic	0.84** (0.06)	0.77*** (0.05)	0.75*** (0.05)	0.75*** (0.05)	0.75*** (0.05)
Special Education	1.00 (0.03)	0.99 (0.03)	0.98 (0.03)	0.98 (0.03)	0.98 (0.03)
English Language Learner	0.83* (0.06)	0.85* (0.06)	0.86* (0.06)	0.86* (0.06)	0.86 (0.06)
Free and Reduced-Price Meals	1.01 (0.04)	0.82*** (0.03)	0.81*** (0.03)	0.94 (0.08)	0.81*** (0.03)
Number of Suspensions	1.03 (0.02)	1.04 (0.02)	1.04* (0.02)	1.04* (0.02)	1.04* (0.02)
Days Suspended	1.01* (0.004)	1.01 (0.00)	1.01 (0.00)	1.01 (0.00)	1.01 (0.00)
Residential Move	8.59*** (0.17)	8.38*** (0.17)	8.57*** (0.17)	8.57*** (0.17)	8.57*** (0.17)
Change Schools Last Summer	1.24*** (0.04)	1.22*** (0.04)	1.25*** (0.04)	1.25*** (0.04)	1.25*** (0.04)
Tract Median Household Income	0.94*** (0.02)	1.03* (0.02)	1.03 (0.02)	1.03 (0.02)	1.03 (0.02)
Tract Percent Bachelor's Degree	0.97 (0.02)	1.03* (0.02)	1.02 (0.02)	1.03 (0.02)	1.03 (0.02)
Tract Violent Crime	0.95** (0.02)	0.92*** (0.02)	0.92*** (0.02)	0.92*** (0.02)	1.02 (0.05)
Live in School Tract	0.88*** (0.02)	0.82*** (0.02)	0.79*** (0.02)	0.79*** (0.02)	0.79*** (0.02)
Total Enrollment		0.72*** (0.02)	1.26*** (0.07)	1.25*** (0.07)	1.26*** (0.07)
Total New Students		1.08*** (0.02)	0.90** (0.03)	0.90** (0.03)	0.90** (0.03)
Total Midyear Moves		1.20*** (0.02)	1.14*** (0.03)	1.14*** (0.03)	1.14*** (0.03)
Test Score Percentile		0.91*** (0.01)	0.94*** (0.02)	0.94*** (0.02)	0.94*** (0.02)
School Percent Black		1.31*** (0.04)	1.58 (0.45)	1.57 (0.45)	1.56 (0.45)
School Percent Hispanic		0.92* (0.03)	1.05 (0.17)	1.05 (0.16)	1.05 (0.16)

School Percent English Language Learners		1.17*** (0.04)	1.40*** (0.14)	1.40** (0.14)	1.40** (0.14)
School Percent Special Education		0.98 (0.01)	1.03 (0.03)	1.03 (0.03)	1.03 (0.03)
School Percent Free and Reduced-Price Meals		1.10*** (0.02)	0.87 (0.09)	0.87 (0.09)	0.87 (0.09)
School Violent Crime*FRM				0.94* (0.03)	
School Violent Crime*Tract Violent Crime					0.96** (0.02)
Constant	0.05*** (0.01)	0.12*** (0.02)	0.32*** (0.07)	0.28*** (0.07)	0.19*** (0.06)
School Fixed-effects			X	X	X
Observations	122,245	122,245	122,245	122,245	122,245
Number of Schools	129	129	129	129	129

Note: Robust standard errors clustered at the school level in parentheses. Violent crime measures have been transformed using the inverse hyperbolic sine function. All other continuous measures have been standardized. All models include indicators for grade and school year. *** p<0.001, ** p<0.01, * p<0.05.

Source: Authors' calculation based on data from the Baltimore City Police Department and the Baltimore City Public Schools.