EXAMINING THE RELATIONSHIP BETWEEN SCHOOL SECURITY MEASURES, SENSE OF SAFETY AND ACADEMIC ACHIEVEMENT USING AN INTERSECTIONAL FRAMEWORK: A MODERATED-MEDIATION MODEL

by

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ABSTRACT

RACHEL SIEGAL. Examining the Relationship Between School Security Measures, Sense of Safety, and Academic Achievement Using an Intersectional Framework: A Moderated-Mediation Model

(Under the direction of DR. RYAN P. KILMER)

School security measures (SSMs), which include school resource officers (SROs), security cameras, and metal detectors, are used in elementary, middle, and high schools across the United States (Musu-Gillette et al., 2019) and can cost school systems up to $21 million per year (DeAngelis et al., 2011). Beyond their cost, SSMs are used frequently even though the available evidence suggests that these measures may compound current disadvantages for certain groups of students (e.g., students who are Black or Hispanic or students who are economically disadvantaged), and that they are associated with lower attendance rates, lower academic achievement, increased student arrest rates, and worse school safety outcomes (such as increased use of drugs, fighting and firearm possession at school). Using a publicly available, national dataset, the current study examined how patterns of SSMs are related to students' perceptions of school safety and reported academic achievement, and how this relationship varied in the presence of different SSMs for students with different sociodemographic identities (e.g., White, not Hispanic/Latina girl) in 6th through 12th grades.

Overall, the presence of SSMs was not significantly associated with sense of safety or academic achievement, and sense of safety was not significantly associated with academic achievement. Results suggest that Black boys felt less safe in the presence of any type of SSM as compared to no SSMs and the association between SSMs and sense of safety was more pronounced for Black boys as compared to White, not Hispanic/Latino boys. Similarly, White,

not Hispanic/Latina girls felt less safe in the presence of SROs only, SROs and cameras, and metal detectors alone or in the presence of other SSMs as compared to no SSMs. While Black boys felt significantly safer than White, not Hispanic/Latino boys when no SSMs were present, there were no patterns of SSMs which were associated with students' increased sense of safety or improved academic achievement for any subgroup.

These findings align with previous research suggesting that SSMs have disparate impacts for students of color and particularly Black students, and do not contribute to increased sense of safety for students. The disparate impact of SSMs for Black students, the limited benefits that SSMs provide, and their economic cost all suggest that SSMs may not be a worthwhile investment for school systems or the students these systems are supposed to support.

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DEDICATION

This work is dedicated to my parents, sister, and Grandma, who have always supported me, and especially while in graduate school. Thank you for being my biggest cheer section.

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CHAPTER 1: INTRODUCTION

School security measures (SSMs) refer to the presence of any of the following: a written code of conduct; a requirement that visitors sign in and wear visitor badges or stickers; security guards or assigned police officers; school staff (other than security guards or assigned police officers) or other adults supervising the hallway; one or more security cameras to monitor the school; locked entrance or exit doors during the day; locker checks; a requirement that students wear badges or picture identification; and metal detectors (Musu-Gillette et al., 2019). SSMs are used in elementary, middle, and high schools across the United States (Musu-Gillette et al., 2019) and can cost school systems up to $21 million per year (DeAngelis et al., 2011). In fact, beyond their cost, SSMs are used frequently even though the available evidence suggests that these measures may compound current disadvantages for certain groups of students (e.g., students who are Black or Hispanic or students who are economically disadvantaged; Kupchik & Ward, 2013), and that they are associated with low attendance rates, low academic achievement (Tanner-Smith & Fisher, 2016), increased student suspension and arrest rates (Gottfredson et al., 2021; Homer & Fisher, 2019), and worse school safety outcomes (such as increased use of drugs, fighting and firearm possession at school; Tanner-Smith, Fisher, Addington & Gardella, 2017). Additionally, research suggests that administrators often decide to use SSMs due to administrators' perceived threat and fear of a school shooting, rather than the likelihood of a school shooting, the degree of bullying or victimization in a school (Madfis, 2016), or research indicating positive impacts of SSMs. The current study examined how SSMs impacted perceptions of school safety and reported academic achievement, and how this relationship varied in the presence of different SSMs for students with different sociodemographic identities.

Defining School Security Measures

While SSMs broadly refer to the presence of a range of safety measures, previous studies have examined subsets of SSMs, or have examined one SSM at a time. Non-independent subsets of SSMs may include: visible SSMs, defined as SSMs that increase oversight of students in school; structural SSMs, defined as SSMs that are physical objects; physical SSMs, defined as SSMs that include personnel or objects; and non-physical SSMs, defined as policies which are used in the school (Reingle Gonzalez et al., 2016; Perumean-Chaney & Sutton, 2013; Steinka-Fry et al., 2016; Tanner-Smith et al., 2017). However, even these subsets are inconsistently operationalized. For example, although Tanner-Smith and Fisher (2016) only include security personnel, security cameras, and metal detectors in their operationalization of visible SSMs, Steinka-Fry, Fisher and Tanner-Smith (2016) use the term visible SSMs to refer to security personnel, security cameras, metal detectors, controlled building access, contraband sweeps, and photo identification methods. Despite the variability in which terms have been used to refer to various combinations of SSMs, important patterns have emerged across studies.

Specifically, non-physical SSMs, which include hall passes, visitor sign-ins, closed campuses, parking regulations and dress codes, have no effect on students' sense of safety (Perumean-Chaney & Sutton, 2013). In studies that examined the impact of multiple types of physical SSMs, which include security personnel, metal detectors, video cameras, and locked doors, locked doors alone had no effect on students' sense of safety (Perumean-Chaney & Sutton, 2013) or academic achievement (Steinka-Fry et al., 2016). Studies which operationalize SSMs – including security personnel, security cameras and metal detectors – as the number of different types of SSMs, have found that increased SSMs are associated with increased threats of harm (Fisher, Mowen & Boman IV 2017), increased avoidance behaviors, increased fearfulness and lower perceptions of safety (Mowen & Freng, 2018). However, these same studies report

conflicting findings regarding how different combinations of security personnel, metal detectors, and security cameras affect students' sense of safety (Lindstrom Johnson et al., 2018; Perumean-Chaney & Sutton, 2013) and academic achievement (Steinka-Fry et al., 2016). In considering these results collectively, it is likely that the poorer outcomes as a result of increased SSMs are related to the presence of security personnel, metal detectors and security cameras, rather than any of the non-physical SSMs (e.g., visitor sign-in sheets) or locked doors. Additionally, given that most schools use more than one SSM (Steinka-Fry et al., 2016), it is important to understand how various combinations of SSMs, rather than individual SSMs or additive counts, may differentially impact students' sense of safety and academic achievement (Tanner-Smith & Fisher, 2016). Therefore, the current study examines how visible SSMs, defined in this study as security personnel, metal detectors and security cameras, impact perceptions of school safety and academic achievement.

Defining School Safety

Within the school climate literature, school safety is defined as the degree of physical and emotional security provided by the school (including students' perceptions of safety at school) and the presence of effective, consistent and fair disciplinary practices within the school (Wang & Degol, 2015). As part of this definition, the school climate literature describes school safety as a single domain with three dimensions: (1) order and discipline, (2) emotional safety, and (3) physical safety (Wang & Degol, 2015). Order and discipline are defined as the degree to which students follow school rules as well as the consistency and fairness of discipline practices, while emotional safety is defined as the presence of caring and supportive staff, availability of emotional-behavioral health supports and an absence of bullying or harassment (Wang & Degol, 2015). Physical safety is used to refer to the amount of violence and aggression (e.g., fighting,

theft, or assault) in a school, whether students and staff feel safe, as well as what measures (e.g., SSMs) are used to ensure the safety of students and staff (Wang & Degol, 2015). However, this definition of physical safety is problematic, because it defines physical safety using a construct (SSMs) which is implemented to improve school safety. Additionally, the degree of school safety is often used as a predictor of students' experiences with bullying and aggression, even though bullying and aggression are elements of the definition of school safety. This tautological and unclear definition of school safety contributes to a poor understanding of what school safety is, what factors impact school safety, and how school safety relates to students' outcomes (Rudasill et al., 2017).

The challenge of defining school safety most likely contributes to the often-inconsistent findings within the school safety literature. Therefore, in this study, school safety is defined as the extent to which students and staff feel safe in the school, referred to as perceptions or sense of school safety. While sense of school safety may include perceptions as experienced and reported by students, school personnel, or parents, students' perceptions of school safety may be more strongly linked to student-level outcomes than school staff or parents' perceptions (Wang & Degol, 2015). Although triangulating perceptions across multiple stakeholder groups is ideal, specifically understanding students' perceptions is critical (Tanner-Smith et al, 2017).

Because student views are central to the present study, the following sections focus on students' perceptions of school safety, and specifically how these perceptions impact the relationship between SSMs and academic achievement, above and beyond other factors related to safety (e.g., prior experiences of victimization and bullying). Given the variability in possible SSM combinations, studies which examine the impact of multiple SSM combinations as well as the impact of individual SSMs on perceptions of school safety, are included.

School Security Measures and School Safety

In one statewide study, there was a small but significant, positive association between students' perceptions of school security personnel and students' perceptions of safety, such that a more positive perception of school security personnel was related to a higher perception of safety at school (Pentek & Eisenberg, 2017). Additionally, students who reported having school security personnel at their school were more likely to report feeling safe than students who did not have school security personnel at their school (Pentek & Eisenberg, 2017). Notably, Black students, students identifying with more than one race, and Hispanic students had more negative perceptions of school security personnel and lower perceptions of safety relative to White and Asian students (Pentek & Eisenberg, 2017). However, Black students were also more likely to feel safe in the presence of a school resource officer (SRO) than students without an SRO (Pentek & Eisenberg, 2017). Importantly, this study did not examine how combinations of SSMs impact students' perceptions of school safety, or how these perceptions impact student outcomes such as academic achievement.

A second study reported that the presence and number of interactions with school security personnel were both unrelated to students' perceptions of safety (Theriot & Orme, 2016). Rather, Black students and students who had experienced victimization felt less safe at school, whereas male students, students with more school connectedness, and students with more positive attitudes towards school security personnel felt safer at school (Theriot & Orme, 2016). Overall, these studies suggest the need to better understand how the presence of combinations of SSMs (including school security personnel) impacts students' perceptions of safety, and how these perceptions impact student outcomes. Additionally, these studies highlight the importance of understanding differences in perceptions of safety across diverse groups of students.

In a statewide, cross-sectional study examining how security personnel and cameras impacted students' perceptions of safety, the presence of security personnel at school as well as the placement of security cameras on the outside of the school were positively associated with students' perceptions of safety, while security cameras on the inside of the school were negatively associated with students' perceptions of safety (Lindstrom Johnson et al., 2018). Black students reported feeling more safe than White students when cameras were present on the outside of the school, and less safe than White students when cameras were present on the inside of the school (Lindstrom Johnson et al., 2018). Of salience here, this study did not examine how combinations of SSMs (e.g., security personnel and cameras) may impact students' perceptions of school safety or how perceptions of school safety impact student outcomes.

However, a separate study, which used data from two time-points, found that when controlling for prior perceptions of school safety and individual and school characteristics such as school disorder, having metal detectors and at least two other SSMs predicted students' perceptions of safety, such that more SSMs predicted decreased feelings of safety across time (Perumean-Chaney & Sutton, 2013). Similarly, studies examining how combinations of SSMs impact school safety outcomes (e.g., suspensions for drug use, fighting and property crime) found that increased SSMs were associated with negative school safety outcomes (Gottfredson et al., 2021; Tanner-Smith et al., 2017).

Notably, a district-wide study found that students who believed that SSMs would be important to implement in their school also felt less safe in school (Booren et al., 2011). The students' lower sense of safety may reflect their prior experiences with bullying or victimization, which may contribute to their desire for any measure that may increase their safety. That said, this study (Booren et al., 2011) did not assess students' current experiences (e.g., victimizations

at school), nor did it assess whether students preferred other responses or methods specific to bullying and victimization (e.g., an anti-bullying program). Additionally, in this study, students predicted whether the presence of SSMs in the future would increase students' sense of safety and did not report on how safe they felt due to SSMs, because no SSMs were currently implemented at their school (Booren et al., 2011). This method of asking students to predict how they would feel in the future, in different circumstances, is potentially unreliable.

Although a review of the literature on SSMs concluded that increased SSMs were associated with a decrease in students' perceptions of safety (Reingle Gonzalez et al., 2016), most studies examining students' perceptions of safety do not explore how combinations of SSM relate to perceptions of school safety. Furthermore, very few studies investigate how perceptions of school safety mediate the relationship between SSMs and academic achievement. The current study addresses this identified gap in the literature.

Of particular salience to the present study, previous research also suggests that specific groups of students within schools feel less safe than others and that their sense of safety may be differentially impacted by the presence of SSMs (see, for example, Lindstrom Johnson et al., 2018). In these studies, differences in safety and related outcomes are often analyzed by race, ethnicity, or gender. These categories (e.g., race, ethnicity, and gender) are socially constructed, are understood within a cultural context, and can be problematic to use (Ackerly & McDermott, 2012; McCall, 2005). As one case in point, although ethnicity is defined as reflecting a common ancestry and a shared cultural heritage (Jaimes et al., 2013), federal agencies in the United States are required to present at minimum only two choices for ethnicity: "Hispanic or Latin[x]" and "Non-Hispanic or Latin[x]" (Humes et al., 2010), which groups various ethnicities into these two categories (e.g., Puerto Rican, Cuban, or Mexican – among others – as Hispanic/Latinx, and Irish

or Scottish – among others – as non-Hispanic/Latinx; Garcia-Navarro, 2015; Jaimes et al., 2013) and simplifies potentially important differences. The following review of the literature uses the terms used by the cited authors. In the present study, the term Hispanic/Latinx is used, which reflects the specific framing of the question used to assess ethnicity (see 'Measures', below), with the acknowledgment that this term(s) is potentially inaccurate or misleading (Jaimes et al., 2013).

In general, the evidence suggests that Black and Hispanic students report less positive perceptions of school safety compared to White students, both within and across school contexts (Perumean-Chaney & Sutton, 2013; Voight et al., 2015). This differential perception of school safety and other experiences (e.g., sense of support) among students of different racial and ethnic backgrounds within the same school is referred to as the racial school climate gap (Voight et al., 2015). Although school climate and school safety are often examined across schools (Voight & Hanson, 2017), the presence of the racial school climate gap suggests that school climate and school safety should also be understood as microclimates within schools, in which different groups of students feel more or less safe within the same school (Voight et al., 2015). Because this framing of a racial school climate gap suggests that different groups of students may feel less safe within the same school, school-wide efforts to increase safety would need to have a more pronounced impact for those groups of students already feeling less safe. Unfortunately, research suggests that SSMs inequitably impact students' victimization experiences, which are related to perceptions of school safety (Fisher et al., 2017), and may further exacerbate the racial school climate gap, leaving students of color feeling less safe in the presence of SSMs than in the presence of no SSMs. Of relevance to this study, few studies have examined how students' (with different racial, ethnic and gender identities) perceptions of safety vary in the presence of

different combinations of SSMs. Therefore, the following section reviews literature about the effect of SSMs on constructs related to sense of safety, such as victimization, for students with different sociodemographic identities.

When comparing student reports of victimization while at school (defined as being threatened with harm, being in a physical altercation, or being stolen from at school), Hispanic adolescents reported fewer experiences of being threatened with harm relative to White adolescents, and there was no significant difference between White and Black adolescents' reports of being threatened with harm, regardless of the number of types of SSMs present (Fisher et al., 2017). However, analyses assessing student-reported physical altercations and theft found that Black adolescents were more likely than White adolescents to report involvement in a physical altercation regardless of number of types of SSMs present, though this finding was more pronounced in schools with fewer types of SSMs than in schools with more types of SSMs. Black adolescents were also more likely to report something stolen from them than White adolescents, however this finding was more pronounced in schools with more types of SSMs (Fisher et al., 2017). There were no differences between Hispanic and White students' reports of involvement in a physical altercation or theft (Fisher et al., 2017). Overall, these studies suggest that the presence and number of SSMs can impact Hispanic, Black, and White students' experiences at school differently, which may contribute to disparate perceptions of safety. Understood within the context of the racial school climate gap, SSMs may be further widening already-present differences in students' perceptions of school safety.

Importantly, other studies have found that girls feel less safe than boys in school, regardless of whether SSMs are present (Lindstrom Johnson et al., 2018; Perumean-Chaney & Sutton, 2013), which suggests that there are also noteworthy gender differences regarding

students' perceptions of school safety. Further research is needed to examine how these multiple sociodemographic identities (gender, race, and ethnicity) interact and inform students' perceptions of safety in the presence of different combinations of SSMs. The current study addresses this identified gap in the literature by exploring differences in perceptions of school safety when in the presence of different combinations of SSMs for Black and White students, across gender and Hispanic identity.

School Security Measures and Academic Achievement

Understanding the potential impact SSMs may have on students' perceptions of school safety is particularly salient in light of the positive association between school safety and students' academic achievement (Wang & Degol, 2015), and how SSMs may therefore impact academic achievement as well. One study, which used a national dataset to examine the impact of metal detectors, school security personnel and security cameras on academic achievement, found a small but significant negative association between SSMs and academic achievement, such that the presence of school security personnel or security cameras was associated with lower academic achievement (Tanner-Smith & Fisher, 2016). This study used student self-report to measure academic achievement, similar to the present study (Tanner-Smith & Fisher, 2016).

Beyond this recent study, very few other studies have examined how SSMs may impact academic achievement. Instead, most studies investigate how SSMs influence variables related to academic achievement, such as absenteeism (Peguero & Bracy, 2015; Tanner-Smith & Fisher, 2016), which is negatively associated with academic achievement (Gottfried, 2014). For example, in one effort, and across two different datasets (one reflecting measures completed by administrators, the other capturing measures completed by students) the presence of school security personnel and security cameras were each associated with increased absenteeism (as

measured by the number of days an adolescent was not in school in the past month) compared to schools with no SSMs, when controlling for potentially confounding characteristics (Tanner-Smith & Fisher, 2016). Given the small but negative relationship between SSMs and academic achievement, and the negative association between SSMs and absenteeism, the current study will replicate and extend these findings, by first examining the relation between SSMs and academic achievement and then examining whether this relationship is mediated by students' perceptions of safety.

Just as Black or Hispanic students may feel less safe at school (racial school climate gap; Voight et al., 2015), the racial academic achievement gap refers to the consistently lower academic achievement of Black and Hispanic students relative to their White peers. It is important to understand the racial academic achievement gap as caused by historical and ongoing interactions among such factors as structural racism (e.g., residential segregation), and poverty (Beck et al., 2019; Charlotte-Mecklenburg Schools Office of Accountability, 2019; Rothstein, 2014). The racial academic achievement gap and the racial school climate gap are related (Voight et al., 2015), and these factors (e.g., structural racism) likely contribute to both.

Specifically, in schools where Black and White students reported larger differences between their perceptions of safety, such that White students felt safer than Black students, Black and White students also experienced larger differences in academic achievement, such that White students achieved significantly more than Black students (Voight et al., 2015). These same trends were observed for Hispanic and White students: in schools where Hispanic and White students reported larger differences between their perceptions of safety, Hispanic and White students also experienced larger differences in academic achievement, such that White students felt significantly safer and achieved significantly more than Hispanic students (Voight et al.,

2015). The consistent and parallel trends between the racial school climate and safety gap and the racial academic achievement gap highlight the need for future research to investigate the nature of these modifiable factors that are driving these observed differences.

Applying an Intersectional Framework to School Safety Research

Despite the documented racial, ethnic and gender differences in perceptions of school safety and academic achievement across students, existing research has typically focused on one aspect of a student's identity (e.g., race, ethnicity, or gender), rather than on the experiences of students with different intersections of these identities (e.g., a student who is a Black, Hispanic/Latina girl). Recently, researchers have emphasized the need to incorporate students' intersecting identities to better understand how SSMs may differentially impact students' perceptions of school safety (Addington, 2019; Carter Andrews & Gutwein, 2020; Carter Andrews et al., 2019; Hines-Datiri & Andrews, 2017; Voight et al., 2015). For example, Black girls and Black boys experience disproportionately higher rates of suspension and expulsion compared to White, Asian, Hispanic, and Native Hawaiian/Pacific Islander boys and girls, with Black boys often experiencing the highest rates of suspension and expulsion, for the same behaviors as White boys (Office for Civil Rights, 2014). However, research has focused primarily on differences between Black and White students' disciplinary exclusion rates (Addington, 2019). While salient in its own right, this sole focus on racial differences in disciplinary exclusion may overlook important differences among students of different races, ethnicities, and genders when in the presence of different patterns of SSMs. Documenting Black girls' experiences, specifically, is important, as Black girls' experiences are informed by interactions between sexism and racism (Crenshaw et al., 2015). Intersectionality provides a framework to better understand these potential differences.

Intersectionality is defined as a critical theoretical framework that focuses on the various ways that individuals experience structural and interpersonal contexts and how these contexts are shaped by social power (Crenshaw, 1989; Bauer & Scheim, 2019). Intersectionality is rooted in qualitative research and has only more recently been incorporated into quantitative research (Bauer & Scheim, 2019; McCall 2005). In using intersectionality in quantitative research, theorists differentiate between descriptive and analytic intersectionality approaches (Bauer & Scheim, 2019).

Descriptive intersectionality research examines the distribution of outcomes across groups as they are defined by multiple, overlapping positions of power and privilege (Bauer & Scheim, 2019). That is, descriptive intersectionality may compare differences in outcomes across groups, such as academic achievement between Black boys and White boys. Descriptive intersectionality approaches are useful for documenting inequalities and shaping the development of a theory (Bauer & Scheim, 2019). When using a descriptive intersectionality approach, it is important to avoid any unintentional reinforcement that observed inequalities are normal and unchangeable or to infer causation from the results (Bauer & Scheim, 2019).

Comparatively, analytic intersectionality is used to better understand the processes which lead to observed outcome inequalities (Bauer & Scheim, 2019). For example, an analytic intersectional approach could examine how a process, such as discrimination, drives observed differences in academic achievement between Black boys and White boys. Analytic intersectionality is particularly useful when analyses can or have already identified outcome inequalities using descriptive intersectionality, because analytic intersectionality can be used to understand the processes that lead to these inequalities as well as potential solutions (Bauer & Scheim, 2019). With that as backdrop, and the somewhat contradictory findings in the SSM and

school safety literature, the current study uses a descriptive intersectionality approach to explore how perceptions of safety vary for students of different sociodemographic groups, when various combinations of SSMs are present.

Specifically, the present study focused on differences among students' (Black boys or girls who are Hispanic/Latinx or not Hispanic/Latinx and White boys or girls who are Hispanic/Latinx or not Hispanic/Latinx) perceptions of school safety and academic achievement in the presence of different combinations of SSMs. These three demographic characteristics are of focus because previous research has found differences in victimization (Fisher et al., 2017), perceptions of school climate (Voight et al., 2015) and perceptions of school safety (Lindstrom Johnson et al., 2018) between and among groups who differ in race, gender, or ethnicity. Specifically, previous research reported differences in victimization, perceptions of school climate and perceptions of school safety between Black and White students, White and Hispanic students, and boys and girls (Fisher et al., 2017; Lindstrom Johnson et al., 2018; Voight et al., 2015), after investigating possible differences on race, ethnicity, or gender. However, these studies did not investigate any differences at the intersections of these identity characteristics (e.g., Black girl). Therefore, the current study builds upon and extends this research by examining how perceptions of school safety vary for adolescents with these specific identities in the presence of different combinations of SSMs.

Differences in perceptions of safety for students of other racial and ethnic groups (e.g., students from Indigenous groups, Asian students, Hawaiian/Pacific Islander students) or genders are not included in the current study, for both conceptual (e.g., building and expanding on previous findings) and statistical reasons (e.g., differences in group size, see 'Analytic Approach' below). Interpretations of study findings will be framed judiciously, with consideration of the

larger context of potential power differentials and racism, so as not to reinforce observed inequalities as acceptable.

Selected Factors Relevant to the Present Study

As indicated by the literature summarized above, students' perceptions of school safety and academic achievement may vary by their race, ethnicity, and gender, with most studies suggesting that Black, Hispanic and female students feel less safe in school, and that White and female students perform better academically (Lindstrom Johnson et al., 2018; Perumean-Chaney & Sutton, 2013; Torres et al., 2020; Voight et al., 2015). In light of these differences, the current study examines how perceptions of safety and academic achievement vary for students with different racial, ethnic and gender identities when different combinations of SSMs are present as compared to no SSMs.

There are multiple variables at the individual, school and neighborhood levels which may be associated with the pattern of visible SSMs used in a school as well as students' perceptions of school safety and academic achievement. These additional variables, described below, are used as control variables in the present work.

Research on SSMs predominantly focuses on middle and high school students, for whom the presence of SSMs are more common. Most studies suggest that younger students (e.g., 5-8th grade) feel less safe in school and perform better academically than older students (e.g., 9-12th grade; Lindstrom Johnson et al., 2018; Perumean-Chaney & Sutton, 2013). Students who live in households with higher incomes are also more likely to receive higher grades (Torres et al., 2020).

Students' interpersonal relationships may impact their perception of school safety as well as their academic achievement. Positive relationships with school staff and high perceptions of

rule fairness are positively associated with increased school safety (Gregory et al., 2010; Steinka-Fry et al., 2016) and increased academic achievement (Torres et al., 2020). At the same time, previous research has shown that students' experiences with bullying and other forms of victimization are associated with lower perceptions of school safety (Fisher, Mowen & Boman IV, 2018; Perumean-Chaney & Sutton, 2013) and lower academic achievement (Gardella et al., 2016; Torres et al., 2020).

Beyond individual and interpersonal factors, school- and neighborhood-level variables may also influence patterns of visible SSMs, as well as students' perceptions of safety and academic achievement. Schools are more likely to have more SSMs if they have larger proportions of low-income or Black or Hispanic students. Larger schools, schools that serve higher grade levels (e.g., 9-12th), urban schools and schools that are located in the south are also more likely to have more SSMs. Additionally, students who report low levels of neighborhood safety and high levels of community disorder feel less safe at school (Perumean-Chaney et al., 2013) and are more likely to attend schools which have higher levels of SSMs (Steinka-Fry et al., 2016). In light of these prior findings and the focus of the current effort, the described factors are used as control variables in the present study.

Current Study

The current study replicates and extends previous research. Specifically, it examines the potential impact of visible SSMs, defined as the presence of any combination of metal detectors, security cameras, and security personnel, by assessing: (a) whether the presence of visible SSMs are associated with lower academic achievement; (b) whether the presence of visible SSMs are negatively associated with students' perceptions of school safety; (c) whether lower perceptions of school safety are associated with lower academic achievement; and (d) whether perceptions of

school safety when in the presence of different combinations of visible SSMs are conditioned on students' racial, ethnic and gender identity.

The control variables described previously – and included in the present study – account for a variety of factors identified in previous research as being salient for predicting schools' use of SSMs, students' perceptions of safety, and students' academic achievement (Torres et al., 2020). The multiple control variables are used to minimize the risk of forming incorrect conclusions based on spurious or suppressed relationships (Torres et al., 2020).

Study results show to what extent visible SSMs are associated with students' academic achievement and perceptions of school safety, and whether perceptions of school safety vary for specific groups of students when visible SSMs are present. The current study addresses several gaps in the literature, specifically: (1) the limited research base examining the association between the presence of visible SSMs and academic achievement as well as between visible SSMs and perceptions of school safety; (2) the lack of conceptual clarity between the definition of school safety and SSMs; and (3) the lack of research examining how perceptions of school safety vary in the presence of different combinations of visible SSMs for students grouped by their intersecting racial, ethnic and gender identities. The current study addresses these identified gaps by using a national dataset of adolescents ages 12 to 18 years to answer the following research questions:

1. Are combination(s) of visible SSMs (metal detectors, security cameras, and security personnel) directly and negatively associated with academic achievement? See Figure 1 for a visual representation.
2. Do students' perceptions of school safety mediate the relationship between visible SSMs and academic achievement? Specifically: a) are visible SSMs negatively associated with

students' perceptions of school safety, and b) are students' perceptions of school safety positively associated with academic achievement? In other words, do visible SSMs directly and indirectly influence academic achievement, with the latter relationship explained by a negative association between visible SSMs and perceptions of school safety and a positive association between perceptions of school safety and academic achievement? See Figure 2 for a visual representation

3. How do students' perceptions of school safety vary in the presence of visible SSMs among students at the intersections of race (White, Black), ethnicity (Hispanic/Latinx, not Hispanic/Latinx), and gender (boy, girl)? That is, does sociodemographic identity, specifically race, ethnicity and gender, moderate the relationship between visible SSMs and perceptions of school safety?

   Specifically, when compared to White, not Hispanic/Latino, boy students (i.e., the reference group) in the presence of any combination of SSMs as compared to no SSMs it is hypothesized that:

   a. White, not Hispanic/Latina girls will feel less safe;
   b. White, Hispanic/Latina girls will feel less safe;
   c. White, Hispanic/Latino boys will feel less safe;
   d. Black, not Hispanic/Latino boys will feel less safe;
   e. Black, Hispanic/Latino boys will feel less safe;
   f. Black, not Hispanic/Latina girls will feel less safe; and
   g. Black, Hispanic/Latina girls will feel less safe.

Of note, I do not have predictions on how 3a through 3g will compare to one another, given the limited research examining how different intersectional identities affect students' perceptions of

school safety in the presence of school security measures. This is an exploratory step. See Figure 3 for a visual representation. Figure 4 displays the full model hypothesized by these three research questions.

CHAPTER 2: METHOD

Participants

Study participants (N = 4,720) completed the 2017 School Crime Supplement (SCS) of the National Crime and Victimization Survey (NCVS). Participants met the following inclusion criteria: (1) completed the NCVS; (2) were 12-18 years old; (3) were U.S. residents enrolled in grades 6-12; (4) attended school at some point in the previous school year; (5) if home-schooled, were not homeschooled for the entire school year, and; (6) attended a public school, as public schools are more likely to be impacted by education reform efforts such as an increased prevalence of SSMs (Gottfredson et al., 2005; Mayer, 2009). To be able to answer research question 3 (i.e., examining the degree to which perceptions of school safety vary in the presence of visible SSMs for students with different intersecting identities, involving race, ethnicity, and gender) and maintain the same sample across all analyses, only White or Black participants (including Hispanic/Latinx participants) were included in the current study (see 'Analytic Approach'). Potential participants were excluded if they attended schools which do not give grades or if the SCS was completed by a parent or guardian, instead of the adolescent. See Figure 1 for a visual representation of how the inclusion and exclusion criteria were applied.

Procedure

This study uses data from the 2017 version of the SCS, a supplemental, secondary dataset publicly available via the Inter-university Consortium for Political and Social Research (ICPSR) website and maintained by the University of Michigan (U.S. Bureau of Justice Statistics, 2017).

Every two years, the Bureau of Justice Statistics (BJS) and the National Center for Education Statistics (NCES) collect the data available in the SCS, as part of the data collection which occurs annually for the NCVS. Therefore, the sampling process used for the NCVS is the same sampling process used for the SCS. The sampling method – a cross-sectional, stratified, multi-stage cluster, random sample rotating-panel design – is described in detail in the SCS codebook (U.S. Bureau of Justice Statistics, 2017). See Appendix A for an overview of the sampling approach. Due to the sampling design, multiple participants may come from the same household and/or school.

Once selected for the sample, eligible respondents in each household were asked to complete the consent process prior to completing the NCVS, via phone or in-person. The 2017 SCS was administered to all NCVS households with eligible participants who completed the NCVS between January and June 2017, and is referred to as an interview. If the eligible participant was not available at the time of the phone or in-person interview, a parent or guardian was asked to participate in a proxy interview. Although individuals can participate in the NCVS and SCS at multiple time-points (e.g., in 2015 and 2017), the data were collected cross-sectionally, and individuals cannot be tracked across years. This study used secondary data and, therefore, was exempt from approval by the Institutional Review Board at the University of North Carolina at Charlotte.

Measures

Visible School Security Measures

The presence of visible SSMs was assessed using an 8-item multi-categorical variable that was dummy-coded such that *no visible SSMs* were coded as the reference group (Hayes & Rockwood, 2017; Tanner-Smith & Fisher, 2016). This variable reflects the different

combinations of visible SSMs at the school, which include: no visible SSMs; only metal detectors; only security cameras; only school security personnel; school security personnel and metal detector; school security personnel and security cameras; metal detectors and security cameras; or school security personnel, metal detector, and security cameras. This visible SSMs variable was created using participants' responses to the following questions: *Does your school take any measures to make sure students are safe such as security guards or assigned police officers; Does your school take any measures to make sure students are safe such as metal detectors or wands; Does your school take any measures to make sure students are safe such as security cameras?* The response options for each question are *yes, no* or *don't know. Don't know* was coded as *no* (Pentek & Eisenberg, 2017).

Perceptions of School Safety

Perceptions of school safety were measured using a single item: *Do you feel safe in your school?* Participants were asked to rate their response on a 4-point Likert scale from (1) *strongly disagree* to (4) *strongly agree*. Participants who responded with *I don't know* were removed from the sample (Perumean-Chaney & Sutton, 2013).

Academic Achievement

Academic achievement was measured as a continuous variable using students' answers to the single-item question: *During this school year, across all subjects have you gotten mostly As, Bs, Cs, Ds, or Fs?* Response options were recoded on a 1-4 scale, with 1 = *Ds or Fs* to 4 = *mostly As* (Tanner-Smith & Fisher, 2016); thus, higher scores reflect better grades or more positive academic achievement. Participants who respond with *I don't know* were removed from the sample. Although the available dataset does not include school- or teacher-reported grades, it is common in education research to use self-reports of student grades (Guo et al., 2015; Kuncel

et al., 2005; Yeager et al., 2016) because students' self-reported GPA is positively correlated with administrative grades (Brand et al., 2003; Fetters et al., 1984). Additionally, previous studies examining academic achievement in this context have used students' self-reported grades as an indicator of academic achievement (Tanner-Smith & Fisher, 2016).

Sociodemographic Variable

An 8-item multi-categorical variable was created that indicated students' intersection of race (White or Black), Hispanic origin (not Hispanic/Latinx or Hispanic/Latinx) and gender (boy or girl; e.g., a White, not Hispanic/Latino boy). In the SCS, participants were asked to indicate their race from a list of 20 answer options. Because the study's research question 3 is specifically written to understand any differences in perceptions of school safety between White and Black, boy and girl students who are or are not Hispanic/Latinx, only participants who answered *White only* or *Black only* for race were included in the analyses (e.g., White, Hispanic/Latina girl; see 'Analytic Approach'). Although other categories of ethnicity exist (e.g., Puerto Rican), the larger study's dataset only includes whether respondents are of Hispanic/Latinx origin; data are not available about other ethnic identities.

To assess for differences in perceptions of safety due to different intersectional identities, the three sociodemographic variables under study (race, ethnicity, gender) were combined as one multi-categorical sociodemographic variable, which included: White, not Hispanic/Latino boy; White, Hispanic/Latino, boy; White, not Hispanic/Latina, girl; White, Hispanic/Latina girl; Black, not Hispanic/Latino, boy; Black, Hispanic/Latino, boy; Black, not Hispanic/Latina, girl; Black, Hispanic/Latina, girl. This sociodemographic, multi-categorical variable was dummy coded with White, not Hispanic/Latino, boy used as the reference group.

Control Variables

Because a variety of factors at the individual, school, and neighborhood levels influence youths' academic achievement and perceptions of school safety and may predict the patterns of visible SSMs that schools use (see 'Selected factors relevant to the present study'), several variables were included as control variables.

Participants' age was included as a control, operationalized as *age at last birthday*. Household income, reported in the NCVS and incorporated with these data, was used as a proxy variable for participants' socioeconomic status and was coded as a 4-point variable (*less than $25,000, $25,000-49,999, $50,000-99,999 and over $100,000*).

Prior victimization was controlled for using a dichotomous variable indicating whether the participant experienced any form of victimization in the past 6 months, including larceny, burglary, physical attack, and rape (Bachman et al., 2011; Nguyen, Yuan & McNeeley, 2019). Prior experiences of bullying were controlled for using a single-item measure that asks students how many days during the school year they were bullied (*did not experience bullying, one day, two days, three to ten days,* or *more than ten days*).

Several subscales were created and used as control variables in the present study. Subscale scores for control variables were calculated as the average of the responses to all of the items within that subscale. The control variable measuring fear of harm at or on the way to school ('fear of harm') consisted of 2 items, *Are you afraid of harm or attack at school?* and *Are you afraid of harm or attack on the bus or on your way to school?* (0 = *Never,* 1 = *Almost/Sometimes/Most of the time;* Nguyen et al., 2019; Tanner-Smith & Fisher, 2016). In the present study, the two items measuring fear of harm had high inter-item correlation ($r = .73$) and demonstrated expected relationships with students' sense of safety ($r = -.25$, $p < .01$) and academic achievement ($r = -.15$, $p < .01$).

The control variable, relationships at school, consisted of three items such as *Do you agree there is an adult at school who really cares about you?* (scores ranged from 1= *Strongly disagree* to 4 = *Strongly agree*; Nguyen et al., 2019). In the present study, the relationships at school subscale demonstrated adequate internal consistency ($\alpha = .85$) and demonstrated expected relationships with students' sense of safety ($r = .42$, $p < .01$) and academic achievement ($r = .20$, $p < .01$).

The control variable measuring students' perceptions of the consistency of school rules ('consistent rules) consisted of four items such as *Would you agree the school rules are fair?* and *Would you agree the school rules are strictly enforced?* (scores ranged from 1 = *Strongly disagree* to 4 = *Strongly agree*; Nguyen et al., 2019). In the present study, the fair rules at school subscale demonstrated adequate internal consistency ($\alpha = .77$) and demonstrated expected relationships with students' sense of safety ($r = .47$, $p < .01$) and academic achievement ($r = .16$, $p < .01$).

School-level control variables were provided within the dataset by the ICPSR and were obtained by matching the respondent's identified school to the 2013-2014 Common Core of Data file or the 2013-2014 Private School Universe Survey (U.S. Department of Justice, 2016). Specifically, school size (*less than 300 students, 300-599 students, 600-999 students, 1,000 – 1,499 students, 1,500 – 1,999 students, 2,000 or more students*), school level (*primary, middle, high, other*), school region (*Northeast, Midwest, South, West*), urbanicity (*City, Suburb, Town, Rural*), total percent of students at the school who are Black, Indigenous or people of color (American Indian/Alaska Native, Asian, Black/African American, Hispanic/Latino, Native Hawaiian/other Pacific Islander; *less than 5 percent, 5 to less than 20 percent, 20 to less than 50 percent, 50 percent or more*) and percent of students at the school who are eligible for free or

reduced-price meals (FRPM; *0 to less than 20 percent, 20 to less than 50 percent, 50 percent or more*) were included as school-level control variables. Variables for which data were not available were coded as missing.

Neighborhood-level differences were also controlled for in the present study. The subscale measuring neighborhood crime consisted of 2 items to which students rated their agreement on a 4-point scale ranging from strongly disagree (1) to strongly agree (4), *Thinking about the neighborhood where you live, there is a lot of crime in the neighborhood where you live* and *Thinking about the neighborhood where you go to school, there is a lot of crime in the neighborhood where you go to school*. In the present study, the two items were strongly correlated ($r = .71$) and demonstrated expected relationships with students' sense of safety ($r = -.37$, $p < .01$) and academic achievement ($r = -.18$, $p < .01$) .

Analytic Approach

As there are ethical and practical barriers to the randomization of visible SSMs in schools, there are no randomized experiments examining this topic (Tanner-Smith et al., 2017); that issue holds for the current work as well. Additionally, because the available data for the present effort were collected at one timepoint, differences between schools prior to implementation of visible SSM patterns cannot be assessed. Although some studies have used propensity score matching as a technique to compare non-randomized groups and minimize selection bias (Tanner-Smith et al., 2017), others strongly discourage using this technique (King & Nielsen, 2019). In view of these issues, preliminary analyses (bivariate correlations and hierarchical multiple regression) were used to identify relationships between the identified control variables and academic achievement. Specifically, in the interest of building parsimonious models, model building using hierarchical multiple regression (HMR) was used,

and control variables which did not explain significant variance in academic achievement were eliminated prior to running the primary analyses.

Primary Analyses

Ordinary least squares regression, specifically a moderated-mediation, was used to answer research questions 1-3. Therefore, a conditional process analysis was used to simultaneously answer these three research questions, using the SPSS PROCESS macro (Hayes & Rockwood, 2017). By performing an analysis in which the multiple relationships were tested simultaneously, the risk of Type I error was reduced (Hayes & Rockwood, 2017). The hypothesized relationships, shown in model form in Figure 4, are presented in Figure 5.

The SPSS PROCESS macro was used to test the direct effect of visible SSMs on academic achievement (path c' in Figure 5; Research Question 1), as well as the indirect effects of visible SSMs on academic achievement as mediated by perceptions of school safety (the product of paths a_1 and b_1; Research Question 2), while controlling for all covariates (represented as U_k in Figure 5; Hayes & Montoya, 2017; Hayes & Preacher, 2013; Hayes & Rockwood, 2017).

Baron and Kenny (1986) originally presented mediation analysis as requiring a step-by-step process, where first the relationship between visible SSMs and academic achievement must be proven before the relationship between visible SSMs and perceptions of school safety and the relationship between perceptions of school safety and academic achievement can be tested. However, recent research suggests that a direct effect of visible SSMs on academic achievement does not need to be proven to be able to test for an indirect effect of visible SSMs on academic achievement through perceptions of school safety (Hayes & Rockwood, 2017; Kenny & Judd, 2014). Instead, the three relationships can be tested simultaneously.

The hypothesized model (see Figure 4) proposed that students' sociodemographic identity moderates the relationship between visible SSMs, perceptions of school safety and academic achievement. Therefore, the SPSS PROCESS macro was used to test, using OLS regression, whether visible SSMs interacted with students' sociodemographic identity (race, ethnicity, and gender) and impacted students' perceptions of school safety (Research Question 3). Although there were multiple categories of racial identities (e.g., Black, White, American Indian/Alaska Native, Asian, Native Hawaiian/Other Pacific Islander) in the broader SCS survey sample, the current study was designed to assess the differences in perceptions of school safety when in the presence of visible SSMs for participants who were White or Black and Hispanic/Latinx or not, due to the documented disparities in related outcomes (e.g., suspensions, arrests, prior victimization) between these groups (Fabelo et al., 2011; Fisher et al., 2017; Homer & Fisher, 2019).

There are conceptual and statistical arguments against grouping the remaining participants into a racial category "*Other"*. Conceptually, this type of grouping simplifies racial identities and ignores potentially significant differences in groups' experiences (Hall, Yip & Zarate, 2016). Statistically, participants from different racial groups may have differing perceptions of school safety, such that these perceptions, when grouped together, hide variance. Additionally, adding more categories to the 8-item sociodemographic variable would increase the risk of Type I error (Hayes & Preacher, 2014) and including other options for racial identity (e.g., Black-Hawaiian/Pacific Islander) in the sociodemographic variable resulted in too small of a sample for that category to run the analyses. Therefore, only participants who identified their race as *Black-only* or *White-only* (and who may or may not be Hispanic/Latinx) were included in the 8-item sociodemographic variable. So that the relationships under examination were tested

using the same sample, only participants who identified their race as Black or White (and who may or may not be Hispanic/Latinx) were included in the sample (Cohen et al., 2003).

The SPSS PROCESS macro provides an index of moderated mediation, which is a value that shows whether the size of the indirect effect (the size of the mediated relationship between visible SSM, perceptions of school safety and academic achievement) is dependent on the moderator (the sociodemographic variable; Hayes & Rockwood, 2017). In other words, the index of moderated mediation shows whether the indirect effect of visible SSMs on academic achievement through perceptions of school safety is a function of – or is conditioned on – sociodemographic identity, the moderator (Hayes & Rockwood, 2017).

In the mediation and moderation analyses that follow, bootstrap confidence intervals were used to determine whether perceptions of school safety significantly mediated the effect of visible SSMs on academic achievement for different sociodemographic identities (Hayes & Montoya, 2017; Hayes & Rockwood, 2017). As described in more detail by Hayes and Rockwood (2017), if the bootstrap confidence interval was entirely above or below zero, the claim of mediation at that value of the moderator was supported. An interaction which had a confidence interval entirely above or below zero was interpreted and probed (Cohen et al., 2003; Hayes & Montoya, 2017). Significant p-values are also reported.

Missing Data

Given the large sample size, listwise deletion was used to remove cases with missing data on the focal variables and control variables (Cohen et al., 2003). Preliminary analyses were used to identify any differences between the survey sample and the removed cases, and Little's Test for Missingness was used to examine the pattern of missing data for focal variables and control variables. A sensitivity check using imputation was performed on the hypothesized mediation

model and the hypothesized moderation model to determine whether there were differences in findings due to the methodology used to deal with missing data (e.g., listwise deletion as opposed to imputation; Azur, Stuart, Frangakis, & Leaf 2011; Rosenbaum, 2002).

CHAPTER 3: RESULTS

Sample Characteristics

Of the 4,720 participants who met the inclusion criteria, 481 (10.2%) did not answer all questions and were not retained for further analyses. Of the 481 participants with missing data, missingness on variables ranged from 0 to 7% (see Figure 6). Little's Test for missingness was significant ($\chi^2 = 307.68$, $df = 2214$, $p < .01$) suggesting that data were not missing at random. The chi-square test for independence was run to determine any differences on outcomes and select characteristics between the sample of participants who met the inclusion criteria but had missing data ($n = 4{,}720$) and the sample of participants who met the inclusion criteria and were not missing data ($n = 4{,}239$). Results indicated that these samples were not significantly different on sense of safety ($\chi^2 = .66$, $df = 3$, $p = .88$) or academic achievement ($\chi^2 = 3.12$, $df = 3$, $p = .37$). Results from the chi-square analyses are presented in Appendix B.

The descriptive statistics reflect the characteristics of the sample of only White and Black participants with no missing data ($n = 4{,}239$). Participants were 15 years old on average ($M_{age} = 14.9$; $SD = 1.9$). Within the sample of participants, 86% of participants identified as White only ($n = 3639$), and 14% identified as Black only ($n = 600$). Approximately 27% of the sample identified as Hispanic/Latinx, and 50% of the sample identified as boys (male). On average, this sample reported feeling safe at school ($M = 3.37$, $SD = .58$) and earning an average grade across all classes of around a B ($M = 3.27$, $SD = .74$). In addition, 7.0% of participants reported the

presence of only an SRO at school, 18.2% reported only a camera, and 60.7% reported the presence of both an SRO and camera.

Due to the low frequency of metal detectors reported at the school (either alone or in the presence of another SSM), metal detectors alone or in the presence of any other type of SSM were combined into one category (9.8%, $n = 415$). Similarly, due to the low frequency of participants who identified as Black, Hispanic/Latino boys, as well as the low frequency of participants who identified as Black, Hispanic/Latina girls, these demographic groups were collapsed to create 6 groups based on sociodemographic identity: (1) White, not Hispanic/Latino boys; (2) White, not Hispanic/Latina girls; (3) White, Hispanic/Latino boys; (4) White, Hispanic/Latina girls; (5) Black boys; and (6) Black girls. Sample characteristics are presented in Table 1. Descriptive statistics for focal variables are presented in Table 2. Descriptive statistics for control variables are presented in Table 3. Means and standard deviations for select control variables for each of the six sociodemographic groups are presented in Table 4.

Bivariate Associations

Examination of bivariate correlations generally reflected a pattern of associations that was consistent with the hypothesized relationships. Having SROs only was negatively associated with sense of school safety ($r = -.05$, $p < .01$) and academic achievement ($r = -.05$, $p < .01$). Having only a camera in the school was positively associated with school safety ($r = .08$, $p < .01$) and academic achievement ($r = .05$, $p < .01$). Having an SRO and a camera in the school was not significantly associated with either school safety or academic achievement, while having a metal detector alone or in the presence of any other type of SSM was negatively associated with school safety ($r = -.05$, $p < .01$) and academic achievement ($r = -.07$, $p < .01$). School safety was positively associated with academic achievement ($r = .18$, $p < .01$). Descriptive statistics and

zero-order correlations for focal variables are presented in Table 2. Descriptive statistics and zero-order correlations for control variables are presented in Table 3.

Relationship Between Control Variables and Academic Achievement

Guided by theory, control variables were grouped into 5 sets to be entered into the model: individual characteristics (age, income, previous experiences of bullying victimization, fear of harm or attack, and previous incidents of victimization), school and neighborhood environment characteristics (caring relationships, consistent rules, neighborhood crime), school demographics (% FRPM, %BIPOC, school level, school enrollment), U.S. region, and urbanicity. Bivariate associations between potential control variables and the focal variables were used to determine the order in which sets of control variables were added when building the model. Specifically, school and neighborhood environment characteristics were entered as the first set because of the higher bivariate associations between the control variables that were included in the school and neighborhood environment set and academic achievement, the outcome variable. The variables reflecting individual characteristics were entered as a second set, followed by school demographics, U.S. region, and urbanicity, because of the lower bivariate associations between the control variables in each of these sets and academic achievement.

Hierarchical multiple regression was used to assess the unique contribution of each of the control variables within each set. The first set of control variables, the school and neighborhood environment characteristics, were entered into the model one at a time, in decreasing size of their zero-order correlations with academic achievement (i.e., caring relationships, neighborhood crime, consistent school rules). The model accounted for 6% of the variance observed in academic achievement ($R^2 = .06$, $p < .01$), and each control variable accounted for a small but

significant ($p < .01$) increase in the variance. Based on model results, all control variables were retained for the primary analyses. Model results are presented in Table 5.

The second model included school and neighborhood environment control variables entered as one set, followed by individual demographic control variables entered into the model one at a time, in decreasing size of their zero-order correlations with academic achievement (i.e., income, fear of harm, bullying, age, violent incident occurred). The set of individual demographic control variables accounted for an additional 4% of variance ($\Delta R^2 = .04$, $p < .01$) in the model and, overall, the model accounted for 10% of the variance observed in academic achievement ($R^2 = .10$, $p < .01$). All control variables except previous victimization, which reflected previous experiences of victimization that did not include bullying, were significantly associated ($p < .01$) with academic achievement. Based on these results, the control variable previous victimization was removed from the included control variables in the final model. Results are shown in Table 5.

The third model included the set of school and neighborhood environment characteristics, followed by the retained individual demographic variables. School demographic variables were then entered into the model one at a time, in decreasing size of their zero-order correlations with academic achievement (% FRPM, % BIPOC, school enrollment, school level). The model accounted for 11% of the variance observed in academic achievement ($R^2 = .11$, $p < .01$), and the set of school demographic control variables accounted for an additional 1% of variance ($\Delta R^2 = .01$, $p < .01$). However, % BIPOC, school enrollment, and school level did not account for a significant amount of variance in academic achievement. Based on model results, % BIPOC, school enrollment, and school level were removed from the included control variables. Results are shown in Table 5.

The fourth model included the retained control variables from the school and neighborhood environment, individual demographic, and school demographic sets. U.S. region was entered as the new set. The total model accounted for 12% of the variance observed in academic achievement ($R^2 = .12$, $p < .01$), and the new control variable of U.S. region accounted for an additional 1% of variance ($\Delta R^2 = .01$, $p < .01$). U.S. region was retained for the model. The fifth model included the 4 identified sets and urbanicity. Urbanicity did not significantly add to the model and was not retained for analyses. Results are presented in Table 5.

Overall, 9 control variables were retained for the primary analyses, and the model with these retained variables accounted for 12% of the variance in academic achievement. The first two sets of control variables largely accounted for this variance – set 1 (school and neighborhood environment) accounted for 6% of variance, and set 2 (individual demographics) added an additional 4% of variance. Sets 3 (school demographics) and 4 (U.S. region) each added an additional 1% of variance. Following this model building using hierarchical multiple regression, the SPSS PROCESS macro was used to test the moderated-mediation model.

Relationship between School Security Measures, Sense of Safety, and Academic Achievement: Testing the Moderated-Mediation Model Using the Conditional Process Macro

The moderated-mediation model tested both a mediation and a moderation process. The following paragraph describes the model that was tested, prior to presenting the results. In the current model, the mediation process was composed of two stages. The first stage was the effect of SSMs (the presumed causal antecedent variable X) on sense of safety (the proposed mediator M), and the second stage was the effect of sense of safety (the mediator M) on academic achievement (the final consequent variable Y). The indirect effect of SSMs on academic

achievement through sense of safety (X on Y through M) was the product of the effects in these two stages. In the tested model, the first stage (SSMs to sense of safety) was also moderated by the sociodemographic variable (W). This relationship is referred to as a relative conditional effect. The indirect effect of SSMs on academic achievement through sense of safety (X on Y through M) in the tested model was also moderated by the sociodemographic variable (W). This relationship is referred to as a relative conditional indirect effect. The SPSS PROCESS macro used a conditional process model to test (1) how differences in SSMs accounted for differences in students' academic achievement, (2) how the relationship between SSMs and academic achievement varied if they were mediated by sense of safety, (3) how sociodemographic identity moderated the relationship between SSMs and sense of safety as well as (4) how sociodemographic identity moderated the indirect relationship between SSMs and academic achievement, mediated by sense of safety.

In the conditional process model, the beta coefficients describe the 1-unit change in SSMs when sociodemographic identity was held at zero. In this model, SSMs and sociodemographic identity were multicategorical and, as such, were coded using reference group coding (also known as indicator coding or dummy coding). Specifically, for SSMs, the presence of no SSMs was coded as the reference group and was the group being referred to when SSMs were held constant at zero. Similarly, for sociodemographic identity, White, not Hispanic/Latino boys were coded as the reference group and were the group being referred to when the sociodemographic variable was held constant at zero.

Effect of School Security Measures on Sense of Safety

For White, not Hispanic/Latino, boys, there was no difference in sense of safety when in the presence of SROs only (b = .04, *ns*), cameras only (b = -.03, *ns*), SROs and cameras (b =

.04=6, *ns*), or metal detectors alone or in the presence of any other type of SSM (*b* = -.03, *ns*), as compared to no SSMs. Conditional process model beta coefficients are presented in Table 6.

Effect of Sociodemographic Identity on Sense of Safety

When no SSMs were present, Black boys felt significantly safer compared to White, not Hispanic/Latino boys (*b* = .48, *p* < .01). There were no significant differences in feelings of safety across the other sociodemographic identities and compared to the reference group when no SSMs were present. Conditional process model beta coefficients are presented in Table 6.

Effect of the Interaction between School Security Measures and Sociodemographic Identity on Sense of Safety

Because both SSMs (the predictor) and sociodemographic identity (the moderator) were multicategorical, 20 products - constructed from the dummy-coded variables representing SSMs and sociodemographic identity - were calculated to test whether the relationship between SSMs and sense of safety was moderated by sociodemographic identity. The effect of the interaction between SSMs and sociodemographic identity on sense of safety is represented by the symbol **"** when reporting results in text and in tables.

Model results suggest that the relationship between patterns of SSMs and sense of safety were moderated by sociodemographic identity, which had a small but significant effect size (ΔR^2 = .01, $F(20, 4201) = 1.79$, $p = .02$). Specifically, White, not Hispanic/Latina girls felt less safe in the presence of SROs only (" = -.18, *p* = .02, *CI* [-.39, .03]), the combination of SROs and cameras (" = -.14, *p* = .03, *CI* [-.30, .03]), as well as the presence of metal detectors alone or in the presence of other SSMs (" = -.20, *p* = .01, *CI* [-.42, .01]) as compared to no SSMs. Black boys felt less safe in the presence of SROs only (" = -.53, *p* <.01, *CI* [-.99, -.07]), the combination of SROs and cameras (" = -.53, *p* < .01, *CI* [-.90, -.15]), cameras only (" = -.60, *p*

< .01, *CI* [-1.04, -.16]) and metal detectors alone or in the presence of other SSMs (" = -.42, *p* < .01, *CI* [-.81, -.03]) as compared to no SSMs. There was no difference in feelings of safety for White boys (regardless of ethnicity) across any pattern of SSMs as compared to no SSMs. Although not significant, White, Hispanic/Latina girls generally felt less safe in the presence of SSMs as compared to no SSMs, and Black girls tended to feel safer in the presence of SROs, SROs and cameras, and cameras alone, as compared to no SSMs. Results are presented in Table 7.

The beta coefficients for the 20 interaction terms (the products constructed from the variables representing SSMs and sociodemographic identity), shown in Table 6, quantify the interaction effect of SSMs for different sociodemographic groups' sense of safety as compared to White, not Hispanic/Latino boys' sense of safety. Analyses indicate that there was a significant, negative, interaction such that the presence of SSMs was more pronounced for Black boys' sense of safety as compared to White, not Hispanic/Latino boys' sense of safety (see Table 6). There were no other significant relationships between SSMs and students' sense of safety.

Effect of Sense of Safety on Academic Achievement

The second stage of the moderated-mediation model tested the relationship between sense of safety and participants' academic achievement when presence of SSMs and sociodemographic identity were held constant at zero. Sense of safety was not related to participants' academic achievement (*b* = .02, *p* = .39, *CI* [-.04, .08]; see Table 6).

Effect of the Interaction between School Security Measures and Sociodemographic Identity on Academic Achievement through Sense of Safety

The moderated-mediation model also tested the relationship between (1) SSMs and academic achievement, (2) SSMs and academic achievement through sense of safety, and (3) the

interaction between SSMs and sociodemographic identity on academic achievement through sense of safety. These results were not significant, suggesting that students' academic achievement was not related to the presence of SSMs or sense of safety. Results are presented in Table 8.

These non-significant results were aligned with the index of moderated mediation, which was not significant for any patterns of SSMs compared across participants with different sociodemographic identities. Results are presented in Table 9. Because the interaction effects and the indices of moderated mediation were not significant, the moderated-mediation model was not probed. A summary of all model results is presented in Table 10.

Sensitivity Check Using Imputation

Multiple imputation in SPSS was used to check how listwise deletion (which was used to handle missing data in the primary analyses) may have impacted relationships in the dataset. Linear regression was used to impute missing variables with 5 imputations. Using the imputed dataset, results for the hierarchical regression model were relatively robust (see Appendix C and Appendix D). The mediation model with academic achievement as the outcome was tested first, where control variables were entered in the first stage, followed by the independent variable, patterns of SSMs, and the mediating variable, sense of safety. Similar to the model from which missing data were removed, patterns of SSMs were not significantly associated with academic achievement or sense of safety and sense of safety was not significantly associated with academic achievement (see Appendix C). The moderation model, with sense of safety as the outcome variable, was tested next, where control variables were entered in the first stage, followed by patterns of SSMs, sociodemographic identity and the interaction terms. Using the imputed data, Black boys' sense of safety in the presence of SSMs as compared to no SSMs was

marginally significant ($p < .10$) and the coefficients were similar in direction and size to results from the primary analyses (see Appendix D). Overall, the sensitivity check using imputation supports results from the primary analyses.

CHAPTER 4: DISCUSSION

The current study examined the relationship between visible SSMs and students' sense of safety and academic achievement, and whether this relationship was different for students with different sociodemographic identities. As part of this effort, the current study also examined the extent to which hypothesized control variables (i.e., relationships at school, previous victimization) were associated with academic achievement.

Overall, results suggested that SSMs were not associated with students' sense of safety and were not related to academic achievement. There were interaction effects such that Black boys and White, not Hispanic/Latina girls had significantly lower perceptions of safety in the presence of SSMs as compared to no SSMs. Additionally, the association between the presence of SSMs and sense of safety was more pronounced for Black boys as compared to White, not Hispanic/Latino boys. The present results raise questions as to why SSMs are placed in schools. In fact, when considered in the context of the broader literature, these results suggest that SSMs have an inequitable impact on students and may be creating unsafe, rather than safer, school environments. These findings can be used by school systems to better understand the impact that certain SSMs or combinations of SSMs can have on students and to inform the reallocation of funding from SSMs to other, more supportive measures.

The current study found no relationship between the presence of SSMs and perceptions of school safety, overall. This was similar to some previous research, which has found that the presence and number of interactions with school security personnel were both unrelated to

students' perceptions of safety (Theriot & Orme, 2016). However, as described previously, findings in this area are mixed. For instance, other research, conducted across several years, has found that having metal detectors and at least two other SSMs predicted students' perceptions of safety, such that students experienced lower levels of safety when SSMs are present (Perumean-Chaney & Sutton, 2013). It may be that this negative association between SSMs and sense of safety was not seen in the current study due to its reliance on cross-sectional data. Alternatively, it may be that students' perceptions of safety in this sample were not related to the presence of SSMs, perhaps because of the ubiquity of SSMs across schools throughout the last two decades. However, it is important to note that particular groups of students – specifically, Black boys and White, not Hispanic/Latina girls – felt less safe in the presence of SSMs; these findings parallel and expand on previous research findings that Black students generally feel less safe in the presence of SSMs (Lindstrom Johnson et al., 2018; Pentek & Eisenberg, 2017), and that girls generally feel less safe than boys (Theriot & Orme, 2016). A summary of these findings is presented in Table 10, and the paragraphs that follow discuss these findings in more detail.

Differential Relationship between School Security Measures and Students' Sense of Safety

Results from this study suggest that students' perceptions of safety in the presence of SSMs varied by students' race and gender, a conclusion which aligns with and adds to previous research (Campos-Manzo et al., 2018). Specifically, White, not Hispanic/Latino boys' perceptions of safety was the same whether in the presence of different combinations of SSMs or no SSMs. Black boys felt significantly safer compared to White, not Hispanic/Latino boys when no SSMs were present. However, Black boys felt significantly less safe in the presence of any type of SSM as compared to no SSMs and the association between SSMs and sense of safety was more pronounced for Black boys as compared to White, not Hispanic/Latino boys. These

findings align with previous research, which suggest that Black students feel less safe in the presence of SSMs (Lindstrom Johnson et al., 2018).

Consistent with the proposed intersectional theory framework, these findings highlight the importance of understanding how perceptions of safety vary for different groups of individuals based on their intersecting identities. Intersectional theory specifies that attention be given to the policies of oppression that create these differential experiences (Crenshaw, 1989). That is, it is imperative to consider context and to appropriately target these broader ecologies, including system practices and policies, not simply explain differences by focusing on the groups involved or the individuals within them. Therefore, study results which describe differential experiences for different groups of students are interpreted within the context of existing policies (e.g., the presence of SSMs).

While previous studies have found that Black youth describe school as a safe place in comparison to unsafe neighborhood areas (DaViera et al., 2020), this association of school and safety was found to be different for Black boys in the presence of SSMs. Schools serving majority Black student populations are more likely to invest in SROs and less likely to have guidance counselors on staff than schools that primarily serve their majority White counterparts (Smith-Evans et al., 2014). These schools have been described as preparing Black youth, and particularly Black boys, for incarceration because of the high levels of control and surveillance in the school (Hirschfield, 2010). Viewed in this context it is evident that policies which appear outwardly to be race-neutral (e.g., the presence of SSMs) may result in more negative experiences for Black students and particularly Black boys, as shown in this study. In that vein, the presence of SSMs in the school environment has been described as contributing to the creation of a carceral environment, characterized by increased surveillance, more social and

physical control and a more punitive approach (i.e., where more types of behaviors are met with punishment and those punishments are relatively harsher; Hirschfield, 2010; Mendoza, 2014; Weaver & Lerman, 2010).

This carceral environment in the school setting may be especially salient for Black boys, because of the targeting that Black boys and men experience within educational settings and throughout other systems. For instance, Black boys are excluded from school (e.g., suspended) at higher rates than other students (Losen & Martinez, 2013; Skiba et al., 2014). Previous research shows that Black youth are aware of inequitable treatment in their school and that inequitable treatment increases in the presence of SSMs (Bottiani et al., 2016). The existence and students' awareness of inequitable treatment when in the presence of SSMs may contribute to Black boys' decreased feelings of safety in the presence of SSMs in the current study. Additionally, outside of school, Black boys experience police harassment and police involvement at higher rates than other youth (Rengifo et al., 2017). As such, their negative perceptions of police are directly related to negative interactions and experiences of harassment (Rengifo et al., 2017) and may inform their decreased feelings of safety when in the presence of SSMs at school.

Intersectional theory (Crenshaw, 1989) and previous research argue for the importance of understanding Black girls' experiences broadly, and within educational settings specifically, as separate and unique from Black boys' or White girls' experiences (Carter Andrews et al., 2019; Crenshaw et al., 2015). Results from this study support this notion and show that there are differences in youths' experiences at the intersection of race and gender. However, findings from previous research suggest that Black girls would feel less safe in the presence of SSMs as compared to no SSMs, and this result was not supported in the current study.

Building on prior research, there are several plausible reasons that the study hypothesis, that Black girls would feel less safe in the presence of SSMs as compared to no SSMs, was not supported in this sample. First, Black girls may not have the same negative association or experiences with SROs or other SSMs as Black boys. For instance, in a qualitative research study in Chicago with predominantly Black youth, girls described feeling unsafe traveling at night or in strange places, due to fear of being sexually harassed or assaulted (Daviera et al., 2020). Although girls in that sample acknowledged that if they were boys, they would be afraid of the police, they less frequently described a fear of police than the boy respondents (Daviera et al., 2020). In a separate mixed-methods study, Black and Hispanic/Latina girls communicated mixed views about police, reporting that in some instances police could stop something from occurring (e.g., sexual harassment when walking home at night); however, when asked for specific examples of encounters, these girls shared uniformly negative interactions (e.g., police not arriving fast enough; police criminalizing someone calling for help; Rengifo et al., 2017). It is possible that, in the presence of SSMs, Black girls' sense of safety were not significantly different than in the presence of no SSMs, because SSMs do not evoke the same feelings of lack of safety for Black girls as they do for Black boys. Alternatively, the mixed views about police reported in recent qualitative studies may explain the non-significant findings in the current quantitative study such that Black girls may view SSMs as useful or protective in some specific instances, but their lived, negative encounters may serve as a counterweight to this view.

Additionally, the presence of visible SSMs such as metal detectors or security cameras may not be associated with Black girls' perceptions of safety, because SSMs may not mitigate or facilitate the sexualization and racialization that Black girls experience. In qualitative research studies, Black girls have described their educational experiences as racialized and gendered, such

that they are held to double standards about appropriate behaviors and required to conform to White-normed constructions of femininity (Carter Andrews et al., 2019; Morris, 2005). For example, Black girls are more likely than White girls to be viewed as unladylike by school staff (Morris, 2005). In other words, it is possible that metal detectors or security cameras do not create further harm, nor do they protect Black girls, in the same way that their presence may threaten or harm Black boys. This possible explanation must be framed with caution and viewed judiciously; it is still true that Black girls are disproportionately excluded from school relative to White girls and White boys, and the presence of SSMs may impact Black girls in a different way than what was measured in the current study (e.g., presence of SSMs may be related to harassment or discrimination and not sense of safety).

In the current study and in contrast to Black girls' experiences, White, not Hispanic/Latina girls reported feeling significantly less safe in the presence of SSMs, specifically in the presence of SROs, SROs and cameras, or metal detectors alone or in the presence of any other type of SSMs, as compared to no SSMs. In this sample, on average, the White, not Hispanic/Latina girls also had a higher family income level than all other groups besides the White, not Hispanic/Latino boys. Previous research finds that increased surveillance strategies are used in neighborhoods with high levels of poverty (i.e., increased police personnel or increased police-owned and operated security cameras) as compared to wealthier neighborhoods (Gilliom, 2011). Additionally, increased police presence and surveillance strategies are more likely to be used in neighborhoods with more people of color than White people (Alexander, 2012; Owusu-Bempah, 2017; Robinson, 2017). At the same time, income and race are tightly interwoven in the U.S. due to on-going policies that reinforce residential segregation and previous policies such as red-lining (Rothstein, 2017). In this context, it is possible that White,

not Hispanic/Latina girls, who on average are wealthier than the Black boys and Black girls in this sample, have not been the objects of surveillance in their neighborhoods; therefore, the presence of SSMs in their schools may be more shocking and send a message to these youth that the school setting is unsafe, as compared to when there were no SSMs.

Notably, the current study found that White Hispanic/Latinx youths' sense of safety was not related to the presence of SSMs as compared to no SSMs. Overall, research exploring Hispanic/Latinx youths' experiences in school and, specifically, their perceptions of safety and academic achievement in the context of SSMs, is sparse (Vargas & Scrivener, 2018). Therefore, study results are considered here within the broader context of previous research examining Hispanic/Latino youths' experiences in the school and neighborhood.

As one possibility, non-significant study findings may be due, at least in part, to the use of the umbrella term "Hispanic/Latinx," which may be obscuring differences in perceptions of safety among different groups of youth (e.g., Puerto Rican youth; Mexican youth). Similarly, and in part due to this heterogeneity among youth identifying with being Hispanic/Latinx, youths' orientation to police may vary. For instance, a prior research study in a predominantly Latino community reported high within-neighborhood heterogeneity in orientations towards police, highlighting the importance of continued research toward understanding Hispanic/Latinx youths' experiences in school and, specifically, how youths' identity (defined more specifically than Hispanic/Latinx) interacts with these experiences. At the same time, previous qualitative research has found that although Hispanic/Latino boys conceptualize police as posing a risk, they identify this risk as unwarranted or misguided policies, rather than targeted risk towards the individual or group (Rengifo et al., 2017). Therefore, it may be that for Hispanic/Latino boys in the current study, SSMs are not perceived as a salient enough threat to elevate the youths'

perceptions of or concerns about safety; rather, they may be perceived as a misguided school policy.

With that as backdrop, it is also important to note that schools with higher percentages of Hispanic/Latinx students are also more likely to have more punitive policies (e.g., out of school suspensions) and are significantly more likely to use more punitive practices (Welch & Payne, 2018), suggesting that schools' race-neutral (in principle) discipline strategies may target and impact Hispanic/Latinx youth more so than White youth. Similarly, in the community (i.e., outside of the school setting), Latinx youth experience high levels of racial profiling and racially targeted surveillance and report that police ignore calls initiated by Latinx residents (Vera Sanchez & Gau, 2015). It is clear that additional research about the varied experiences of Hispanic/Latinx youth in schools is warranted.

Relatedly, news articles reported that only one year after the election of President Trump, fear of deportation had led to fewer residents leaving their homes in one predominantly Latinx community in Chicago (Eltagouri, 2017). Viewed within that context, it may be that some Hispanic/Latinx youth did not complete the current survey, which may be associated with the U.S. government through its connection to the U.S. Department of Labor and Bureau statistics, due to fear of deportation for themselves or family members. Due to the secondary nature of the dataset and the limited information available about demographic breakdowns of completion rates, it is not possible to assess to what extent this was true.

Although previous literature suggests a relationship between sense of safety and academic achievement (Wang & Degol, 2015), this study found no relationship between students' sense of safety and academic achievement and found no relationship between students' sense of safety and academic achievement in the presence of SSMs and moderated by students'

sociodemographic identity. However, control variables related to school environment characteristics, which were entered as one set, did account for a small portion of variance in academic achievement. Since sense of safety is often conceptualized as part of the school environment, it is possible that the operationalization of sense of safety in this study did not capture feelings of safety that were not already accounted for by other school environment characteristics.

According to previous research, the presence of school security personnel or security cameras was associated with lower academic achievement (Tanner-Smith & Fisher, 2016), although the practical significance of this association was low. In this prior work, the authors concluded that the presence of visible SSM had no sizeable effect on academic performance, similar to the results of the current study. It may be that the operationalization of academic achievement in the current study – which relied on students' self-report of their average letter grade across all school subjects – resulted in low variability and, crucially, may not accurately reflect students' actual earned grades (Schwartz & Beaver, 2015; Zimmerman et al., 2002). Future research examining the relationship between safety and academic achievement should measure academic achievement using multiple indicators (e.g., grades, test data) from school systems' administrative data.

Control Variables Associated with Academic Achievement

Previous research examining SSMs using large, secondary datasets has predominantly used propensity score matching to control for differences between schools with different patterns of SSMs (Fisher et al., 2017; Tanner-Smith & Fisher, 2016). These studies have included variables in the propensity score using a theoretical but not statistical rational for inclusion. At the same time, district- or state-specific studies which have been able to use data at two or more

timepoints, have been somewhat limited in the potential control variables available for use (Lindstrom Johnson et al., 2018; Pentek & Eisenberg, 2017; Perumean-Chaney & Sutton, 2013; Theriot & Orme, 2016). The current study contributes to the literature through its exploration of control variables to be included when examining the relationship between SSMs and academic achievement using hierarchical multiple regression for model building. Overall, results suggested that school environment characteristics and individual characteristics, rather than school demographic characteristics, accounted for larger amount of variance in students' academic achievement. This conclusion is discussed further in the following paragraphs and is presented with the caveat that the variable operationalizing academic achievement – self-reported grades – had low variability, which may have contributed to some of the non-significant findings.

School environment characteristics were entered into the model first and accounted for the largest variance in academic achievement of the three sets of control variables. Specifically, control variables related to the presence of caring relationships, the presence of consistent school rules, and fear of crime in the neighborhood in which the school is located all accounted for variance in students' academic achievement. These results are supported by previous research efforts, which have found that schools with high levels of authoritative school climate, reflected by disciplinary structure (e.g., fair rules) and student support (e.g., caring relationships), are associated with lower suspension rates and reduced rates of substance use and mental health concerns (Cornell & Huang, 2016; Gregory et al., 2011; Larusso et al., 2008). However, in the current study, sense of safety and the presence of SSMs, both aspects of the school climate definition proposed by Wang and Degol (2016), were not related to academic achievement. Results from the current study suggest that it may be important to reconceptualize the construct of safety – or at least sense of safety and presence of SSMs – as separate from school climate.

Individual characteristics were entered into the model as a set that included the student's family's income, previous bullying victimization, other experiences of victimization, age, and the student's fear of harm. Except for previous (non-bullying) experiences of victimization, each of these variables were related to academic achievement and retained as control variables; these results largely align with findings from the existing literature. For example, recent research suggests that policy interventions targeting family income, such as increases in the earned income tax credit for families with children, would positively impact academic achievement and related outcomes, including increased likelihood of completing high school, completing college, being employed as a young adult, and earning more over their lifetime (Bastian & Michelmore, 2018).

Although previous bullying victimization and fear of harm were both associated with academic achievement in this study, the variable capturing other forms of victimization was not; given prior research, this was unexpected. Because a very small subset of youth in this sample reported other forms of victimization, it is possible that, in such a large sample, any impact of this variable (i.e., other prior victimization) was washed out. Alternatively, it is possible that previous victimization experiences may impact youths' academic achievement through their current fear of harm while at school. It may be that the variance associated with fear of harm captured any variance associated with previous victimization. Previous research has established links between experiences of victimization and academic achievement, showing that exposure to violence in childhood has a strong, negative impact on students' absenteeism, academic achievement on standardized tests, and graduation rates (Fry et al., 2018). Previous victimization also has a significant, negative impact on youths' health outcomes (Bogart et al., 2014; Hager & Leadbeater, 2016; McGeough & Sterzing, 2018; Schacter, 2021). Although previous

victimization was not significantly associated with academic achievement in this sample, there is a large body of literature demonstrating the multitude of impacts of previous victimization, which should not be discounted.

Among the control variables, school demographic characteristics were entered into the model last and accounted for a small amount of variance in academic achievement. Specifically, the school's percent of students on FRPMs accounted for variance in students' academic achievement, such that a higher percent of students receiving FRPMs was associated with poorer academic achievement. The percent of students at a school on FRPMs has been demonstrated to capture elements of educational disadvantage that household income data do not (Domina et al., 2018) and it can be used as a proxy measure for educational disadvantage, in addition to family income (Domina et al., 2018). FRPM has also been used as a crude measure of school-level poverty (Chetty et al., 2014; Morris & Perry, 2016). Generally, research suggests that environments characterized by poverty have limited resources and, as such may negatively impact academic achievement (Gordon & Cui, 2016; Shaw & McKay, 1942). The current study supports these findings.

Multiple other school demographic characteristics, including the percent of students who are Black, Indigenous or students of color, school enrollment, and school level did not account for any differences in students' academic achievement. This finding was surprising, as previous research has suggested that students at schools with higher percentages of Black, Indigenous or students of color or with higher enrollment report lower perceptions of safety (Lindstrom Johnson et al., 2018; Voight et al., 2016), which is generally thought to be related to academic achievement (although that relationship was not supported in this study; Wang & Degol, 2016). One possible reason for this finding is the low variation in students' self-reported grades. In

addition, school environment characteristics, specifically the presence of supportive adults at school, may mitigate the potential negative impacts of any of these variables on academic achievement. Similarly, student age may have accounted for any variation in academic achievement that would have been accounted for by school level. Finally, because income and race are strongly related in the U.S., due to historical and current policies (e.g., redlining, neighborhood push-out), it is also possible that including students' family income and schools' percent of students on FRPM accounted for any variance in academic achievement which in previous studies (e.g., Lindstrom Johnson et al., 2018) was accounted for by the percent of Black, Indigenous or students of color at the school or the school enrollment.

Study Contributions, Limitations and Future Research

Overall, this study contributes to the current literature by highlighting the importance of considering school environment and individual characteristics when examining the relationships between SSMs, safety, and academic achievement. Notably, results from the current study suggest that SSMs did not improve students' sense of safety and were not related to academic achievement. Additionally, the presence of SSMs was negatively related to Black boys' and White girls' sense of safety. These results raise questions as to why SSMs are placed in schools.

When viewed within the context of the existing literature describing the negative effects of SSMs on various outcomes, the first and primary recommendation from this study is to reduce or remove SSMs from schools. As found in this study, SSMs are not related to students' perceptions of safety or academic achievement, and for Black boys and White, not Hispanic/Latina girls, are associated with these students' feeling less safe at school.

Further underscoring the negative potential consequences of SSMs, prior research in this area finds that the presence of school police officers does not effectively reduce misdemeanors or

violence over time (Dohy & Banks, 2016). Instead, the presence of school police officers relates to an increase in misdemeanors and violence at the initial implementation of these measures, suggesting that the presence of control and surveillance methods may lead to misbehavior through alienation and feelings of mistrust (Dohy & Banks, 2016; Gottfredson et al., 2021). Alternatively, the increased presence of control and surveillance strategies (e.g., SSMs) may result in age-appropriate youth behavior being criminalized (Dohy & Banks, 2016).

As shown in the current study, these outcomes can be worse for youth of color. Racial disparities in school discipline are unlikely to be eradicated unless institutional policies and practices such as SSMs which contribute to disparate school experiences are also addressed (Anyon et al., 2018). Study results suggest that the presence of SSMs are associated with lower feelings of safety, particularly for Black boys, and may further racial inequality. In other words, a policy that should impact all students equally may have a negative impact for Black boys. Future research should continue to examine the extent to which policies and practices inequitably impact certain groups of students and the mechanisms by which these policies and practices reproduce existing inequities (Anyon et al., 2018).

Additionally, this study highlights the importance of caring relationships and consistent and fair school rules for students' academic achievement. Future research should continue to examine how these aspects of school climate contribute to positive outcomes for students (Cornell & Huang, 2016). While authoritative school climate theory has highlighted the importance of a fair discipline structure, it may be important to reconceptualize this construct as an equitable discipline structure, given the importance of race-conscious policies to achieve equitable outcomes (Anyon et al., 2018). For example, school administrators and researchers have recently reconceptualized school-wide interventions such as Positive Behavior

Interventions and Supports (PBIS) to more explicitly address and reduce racial disparities in student outcomes (Boneshefski & Runge, 2014; McIntosh et al., 2018). In reviewing the results from the current study and prior research (e.g., the negative impact of SSMs for student outcomes and the positive impact of other aspects of the school climate such as caring relationships), school districts and administrators should consider how funding that is currently directed towards SSMs can be reallocated to policy and program changes that support positive student outcomes.

Limitations

It is important that this study is interpreted within the context of its limitations. First, the data were cross-sectional, which limits the ability to understand the impact of SSMs on students' sense of safety and academic achievement over time. Although control variables were included in the model, it is possible that students at schools with SSMs present already felt unsafe prior to SSMs being implemented at the school. In addition, as discussed previously, the operationalization of academic achievement may have limited the reliability of and variance in the variable, as students – and specifically academically lower-performing students – overreport their grade by at least half a letter grade (Schwartz & Beaver, 2015; Zimmerman et al., 2002). This overreporting may have contributed to the non-significant relationship between sense of safety and academic achievement, as well as the non-significant relationship between presence of SSMs and academic achievement. Moreover, in the current study, although analyses controlled for school-level characteristics, it would have been more appropriate to use multilevel modeling for analyses, as students are nested within classrooms, which are nested within schools. Unfortunately, the data did not allow for that to occur, because school identifiers were not included in the dataset. Also, (as an early effort using an intersectional framework to

quantitatively assess the impact of SSMs) the current study examined a small subset of intersecting identities and limited those identities to specific categories. Future research which includes additional identities (e.g., socioeconomic status, disability status, sexual orientation) or more broadly defines those identities (e.g., a more inclusive set of gender identities beyond boy and girl), will be critical to continuing to understand the relationship between the presence of SSMs and student outcomes.

Conclusion

Youth spend a large amount of time in their school, and schools are an important setting for youth development (Eccles & Roeser 2011). As such, a key aspect of schools is creating contexts that promote youth success. Although visible SSMs are one measure that schools may have used to promote safe learning environments, the current study suggests that SSMs are not positively related to students' sense of safety and are not related to academic achievement. Additionally, the relationship between SSMs and sense of safety varies for different groups of students, and Black boys' and White girls feel less safe in the presence of SSMs. This study highlights the disparate relationship between visible SSMs and sense of safety for certain groups of students and adds to a growing narrative emphasizing the need to re-examine the inequitable impacts of race-and gender-neutral policies, in schools and communities. Additional research which examines differences in academic, behavioral and social outcomes for different groups of students over time with the introduction or removal of SSMs is warranted. Amidst a growing reckoning around racial (in)justice across the country, and specifically a growing recognition of the harmful impact police can have on Black communities, (Jacobs et al., 2020), school systems should carefully evaluate the role that SSMs play in the school and the extent to which these measures protect or harm students, particularly Black students.

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Table 1

Key Sample Characteristics

	M (SD) or % (N)
Age	14.9 (1.9)
School level	
Primary	3.4% (144)
Middle	31.5% (1337)
High	60.0% (2545)
Other	5.0% (213)
School enrollment	
Less than 300	8.5 (360)
300-599	17.5 (743)
600-999	25.0 (1059)
1,000 -1,499	20.0 (847)
1,500-1,999	14.5 (614)
2,000 or more	14.5 (616)
Race	
Black	14.2% (600)
White	85.8% (3639)
Hispanic/Latinx	26.8% (1135)
Male	50.0% (2119)
Income	
<$25,000	17.6% (748)
$25,000 - 49,999	24.4% (1036)
$50,000 - 99,999	32.2% (1364)
>$100,000	25.7% (1091)

Note. $N = 4239$.

Table 2

Descriptive Statistics and Zero-Order Correlations for Focal Variables

	M (*SD*) or % (N)	Correlation coefficient	
		Sense of safety	Academic achievement
School security measures (SSMs)[a]			
No SSMs	4.4% (185)	--	--
SRO only	7.0% (297)	-.05*	-.05*
Camera only	18.2% (772)	.08*	.05*
SRO and camera	60.6% (2570)	-.02	.03
Metal detector alone or with other SSMs[b]	9.8% (415)	-.05*	-.07*
Sociodemographic variable[c]			
White, not Hispanic/Latino boy	30.7% (1301)	--	--
White, not Hispanic/Latina girl	29.0% (1228)	.04*	.18*
White, Hispanic/Latino boy	12.7% (538)	-.05*	-.13*
White, Hispanic/Latina girl	13.5% (572)	-.07*	.00
Black boy	6.6% (280)	-.02	-.11*
Black girl	7.5% (320)	-.06*	-.03
Sense of safety[d]	3.4 (.58)	--	--

Academic achievement[e]	3.3 (.75)	.17*	--

Note. N = 4239. SRO = School Resource Officer.
[a] For analyses, SSMs were dummy coded with NO SSMs as the reference group. [b] Preliminary data exploration showed that keeping the categories of metal detectors alone, metal detectors and SROs, metal detectors and cameras, and metal detectors SROs and cameras separate was very small compared to the entire sample. Therefore, these four groups were combined into one larger category, represented here. [c] For analyses, the sociodemographic variable was dummy coded with White not Hispanic/Latino boy as the reference group. Preliminary data exploration showed that the categories Black Hispanic/Latino boy, Black, not Hispanic/Latino boy, Black, Hispanic/Latina girl and Black, not Hispanic/Latina girl were very small compared to the entire sample. Therefore, these four groups were combined into two categories, Black boy and Black girl. [d] Sense of safety was coded such that higher scores indicated a more positive or stronger sense of safety. [e] Academic achievement was coded such that higher scores indicate higher grades.
*$p < .01$.

Table 3

Descriptive Statistics and Zero-Order Correlations for Control Variables

				School Security Measures (SSMs)[a]			
	M (*SD*) or % (N)	School safety	Grades	SRO only	Camera only	SRO and camera	Metal detector alone or with other SSM
Age	14.9 (1.9)	-.05**	-.04**	-.03	-.12**	.11**	.06**
Income	2.66 (1.05)	.14**	.21**	-.02	.06**	.05**	-.13**
Bullying[b]	22.0% (931)	-.13**	-.10**	-.03*	.03*	.04*	-.04**
Fear of harm	0.17 (.41)	-.25**	-.15**	.04*	-.06**	-.04*	.12*
Violent incident	0.04 (.19)	-.11**	-.04**	-.03*	-.01	.05**	-.04**
Caring relationships	3.38 (.49)	.42**	.20**	-.08**	.02	.06**	-.04**
Consistent rules	3.15 (.48)	.46**	.15**	-.02	.02	-.01	.00
Neighborhood crime	1.69 (.60)	-.37**	-.18**	.08**	-.09**	-.04*	.11**
School level[c]	1 .67 (.63)	-.02	-.02	-.05**	-.09**	.10**	.06**
School enrollment[d]	2.58 (1.50)	-.04**	-.02	.08**	-.32**	.24**	.04**
% BIPOC	2.05 (.93)	-.13**	-.12**	.11**	-.25**	.03*	.18**
% FRPM	1.26 (.73)	-.14**	-.17**	.03	-.07**	-.06**	.16**

U.S. Region[e]							
Northeast	7.8% (328)	.01	.06**	-.04**	-.01	.01	.05*
Midwest	28.4% (1202)	.07**	.03*	-.13**	.26**	-.06**	-.09**
West	22.7% (960)	-.03	-.04*	.08**	-.03*	-.01	-.08**
Urbanicity[f]							
Suburb	25.9% (1097)	.04**	.06**	.02	-.08**	.10**	-.05**
Town	13.3% (563)	.02	-.02	-.06**	.10**	-.03	-.03
Rural	24.0% (4228)	.02	.02	-.02	.13**	-.09**	-.06**

Note. N = 4239. SROs = School resource officers. % BIPOC = Black, Indigenous, People of Color as the percent of school enrollment. % FRPM = Free or reduced-price meals as the percent of school enrollment.
[a] No SSMs is the reference group. [b] Percent and number of students who reported being bullied at least one day. [c] School level ranged from 1 (elementary school) to 3 (high school). [d] School enrollment ranged from 1 (less than 300 students) to 6 (more than 2,000 students). [e] South is the reference group. [f] City is the reference group.
*$p < .05$. **$p < .01$

Table 4

Descriptive Statistics for Sociodemographic Identity and Select Control Variables

	Mean (*SD*)					
	White, not Hispanic/ Latino boy[a]	White, not Hispanic/ Latino girl[b]	White, Hispanic/ Latino boy[c]	White, Hispanic/ Latino girl[d]	Black boy[e]	Black girl[f]
Income	2.97 (.97)	2.97 (.98)	2.20 (.96)	2.22 (.96)	2.22 (1.01)	2.16 (.97)
Bullying	.48 (1.09)	.72 (1.28)	.29 (.84)	.45 (1.03)	.37 (.93)	.57 (1.10)
Fear of harm	.13 (.34)	.17 (.43)	.17 (.38)	.20 (.43)	.19 (.44)	.26 (.51)
Caring relationships	3.38 (.47)	3.45 (.49)	3.27 (.49)	3.34 (.49)	3.32 (.51)	3.34 (.48)
Consistent rules	3.18 (.46)	3.13 (.50)	3.15 (.46)	3.15 (.45)	3.11 (.51)	3.07 (.53)
Neighborhood crime	1.59 (.59)	1.59 (.55)	1.81 (.63)	1.86 (.58)	1.84 (.63)	1.83 (.61)
School level[g]	1.64 (.62)	1.68 (.64)	1.68 (.63)	1.63 (.64)	1.70 (.57)	1.72 (.62)
School enrollment[h]	2.41 (1.47)	2.43 (1.52)	2.88 (1.44)	2.87 (1.57)	2.70 (1.46)	2.69 (1.49)
% BIPOC	1.65 (.89)	1.65 (.89)	2.58 (.66)	2.62 (.69)	2.62 (.63)	2.74 (.52)
% FRPM	1.06 (.71)	1.03 (.73)	1.54 (.65)	1.60 (.62)	1.55 (.63)	1.63 (.58)
Violent incident	.04 (.20)	.04 (.20)	.03 (.17)	.03 (.17)	.05 (.21)	.03 (.18)

Note. % BIPOC = Black, Indigenous, People of Color as the percent of school enrollment. % FRPM = Free or reduced-price meals as the percent of school enrollment. [a]$n = 1301$. [b]$n = 1228$. [c]$n = 538$. [d]$n = 572$. [e]$n = 280$. [f]$n = 320$. [f]School level ranged from 1 (elementary school) to 3 (high school). [h]School enrollment ranged from 1 (less than 300 students) to 6 (more than 2,000 students).

Table 5

Model Building Using Hierarchical Multiple Regression with Academic Achievement as the Outcome

Model	Predictors	b[LL, UL]	SE	R^2	ΔR^2
School environment				.06**	.06
	Relationships	.22** [.17, .27]	.03		
	Crime	-.16** [-.20, -.12]	.02		
	School rules	.10** [.05, .15]	.03		
Individual characteristics				.10**	.04
	(School environment)	-			
	Income	.12** [.10, .15]	.01		
	Fear of harm	-.15** [-.21, -.09]	.03		
	Bullying	-.05** [-.07, -.03]	.01		
	Age	-.02** [-.03, -.01]	.01		
	Violent incident[a]	-.05 [-.16, .07]	.06		
School demographics				.11**	.01
	(School environment)	-			
	(Individual characteristics)	-			

	% FRPM	-.08** [-.12, -.04]	.02		
	% BIPOC[b]	-.02 [-.05, .01]	.01		
	Enrollment[c]	-.01 [-.03, .01]	.01		
	School level[d]	-.01 [-.05, .04]	.02		
U.S. Region				.12**	.01
	(School environment)	-			
	(Individual characteristics)	-			
	(School demographics)				
	Northeast	.10** [.01, .18]	.04		
	Midwest	-.03 [-.08, .03]	.02		
	West	-.08** [-.12, -.02]	.02		
Urbanicity				.12	.00
	(School environment)				
	(Individual characteristics)				
	(School demographics)				
	(U.S. Region)				
	Suburb	.02 [-.04, .08]	.03		

Town	.00 [-.07, .07]	.04
Rural	.05 [-.01, .12]	.03

Notes. $N = 4239$. [LL, UL] indicates the lower and upper limits of a 95% confidence interval calculated based on 10,000 bootstrapped resamples. % BIPOC = Black, Indigenous, People of Color as the percent of school enrollment. % FRPM = Free or reduced-price meals as the percent of school enrollment.

[a]Due to non-significant results, the variable violent incidents was removed from the set for subsequent models. [b]Due to non-significant results, the variable % BIPOC was removed from the set for subsequent models. [c]Due to non-significant results, the variable enrollment was removed from the set for subsequent models. [d]Due to non-significant results, the variable school level was removed from the set for subsequent models.

**$p < .01$.

Table 6

Conditional Process Model Coefficients Predicting Sense of Safety and Academic Achievement

	Sense of Safety		Academic Achievement	
Predictor	*b*	SE	*b*	SE
SSMs				
SRO only	.04	.09	-.08	.06
SRO-CAM	-.03	.06	.01	.05
CAM	.06	.06	.04	.06
MD+	-.03	.08	-.03	.06
Sociodemographic identity				
White, not Hispanic/Latina girl	.09	.08		
White, Hispanic/Latino boy	-.05	.12		
White, Hispanic/Latina girl	-.02	.11		
Black boy	.48**	.15		
Black girl	-.19	.17		
Interactions				
SRO x White, not Hispanic/Latina girl	-.21*	.12		
SRO x White, Hispanic/Latino boy	.03	.15		
SRO x White, Hispanic/Latina girl	-.14	.13		

SRO x Black boy	-.56**	.20		
SRO x Black girl	.11	.21		
SRO-CAM x White, not Hispanic/Latina girl	-.11	.09		
SRO-CAM x White, Hispanic/Latino boy	-.02	.12		
SRO-CAM x White, Hispanic/Latina girl	-.05	.11		
SRO-CAM x Black boy	-.49**	.16		
SRO-CAM x Black girl	.18	.18		
CAM x White, not Hispanic/Latina girl	-.14	.09		
CAM x White, Hispanic/Latino boy	.01	.13		
CAM x White, Hispanic/Latina girl	-.12	.12		
CAM x Black boy	-.66**	.18		
CAM x Black girl	.25	.20		
MD+ x White, not Hispanic/Latina girl	-.17	.11		
MD+ x White, Hispanic/Latino boy	.12	.14		
MD+ x White, Hispanic/Latina girl	.07	.13		
MD+ x Black boy	-.39*	.17		
MD+ x Black girl	.08	.18		
Sense of safety	--	--	.02	.02
Control variables				

Supportive relationships	.29**	.02	.20**	.03
Fear of crime	-.20**	.01	-.07**	.02
School rules	.34**	.02	.06*	.03
Fear of harm	-.16**	.02	-.13**	.03
Bullying victimization	-.02**	.01	-.05**	.01
Age	.00	.004	-.02**	.01
Family income	-.01	.01	.10**	.01
% FRPM	-.04**	.01	-.08**	.02
Model summary	$R^2 = 0.37$		$R^2 = 0.11$	
	F(37, 4201) = 65.25**		F(13, 4214) = 41.71**	

Note. *N* = 4239. SSMs = School security measures. SRO = School resource officer. SRO-CAM = SROs and camera. CAM = Camera. MD+ = Metal detector alone or in the presence of any other type of SSMs. % FRPM = Free or reduced-price meals ass the percent of school enrollment.
*$p < .05$. **$p < .01$.

Table 7

Relative Conditional Effects[a] *of Patterns of School Security Measures (SSMs) on Sense of Safety*

	Relative Conditional Effect			
	SRO only	SRO-Camera	Camera only	Metal detector+
	$\theta_{D1->M}$ [LL,UL]	$\theta_{D2->M}$ [LL,UL]	$\theta_{D3->M}$ [LL,UL]	$\theta_{D4->M}$ [LL,UL]
White, not Hispanic/Latino boy	.04 [-.19, .26]	-.03 [-.20, .13]	.06 [-.11, .23]	-.03 [-.23, .17]
White, not Hispanic/Latina girl	-.18* [-.39, .03]	-.14* [-.30, .03]	-.09 [-.26, .09]	-.20* [-.42, .01]
White, Hispanic/Latino boy	.06 [-.24, .36]	-.05 [-.32, .21]	.07 [-.23, .36]	.09 [-.19, .38]
White, Hispanic/Latino girl	-.10 [-.36, .16]	-.09 [-.32, .14]	-.06 [-.33, .19]	-.04 [-.23, .32]
Black boy	-.53** [-.99, -.07]	-.53** [-.90, -.15]	-.60** [-1.04, -.16]	-.42** [-.81, -.03]
Black girl	.15 [-.34, .63]	.15 [-.28, .58]	.31 [-.18, .79]	.05 [-.39, .50]

Note. $N = 4239$. SRO = School resource officer. SRO-Camera = School resource officer and camera. Metal detector+ = Metal detector alone or in the presence of any other SSM. $\theta_{DX->M}$ represents the difference (θ) in sense of safety (M) for students without a SSM compared to students with the identified SSM (DX). D1 = SRO only. D2 = SRO and camera. D3 = Camera only. D4 = Metal detector alone or in the presence of any other type of SSMs. Bootstrap confidence intervals were conducted to determine whether the relative conditional effects were significantly different from zero. LL = Lower level confidence interval. UL = Upper level confidence interval.

[a] The effects in this model are referred to as *relative conditional effects* because (1) the predictor variable, SSMs, is multicategorical (meaning the effect of SSMs on sense of safety is *relative to* the reference group of no SSMs) and (2) the effect of SSMs is moderated by sociodemographic identity (meaning the effect of SSMs on sense of safety is also *conditioned by* sociodemographic identity).

*$p < .05$. **$p < .01$.

Table 8

The Relative Conditional Indirect Effects[a] *of Patterns of School Security Measures (SSMs) on Academic Achievement*

	Relative Conditional Indirect Effect			
	SRO only	SRO-Camera	Camera only	Metal detector+
	$\theta_{D1->M}b$ [LL,UL]	$\theta_{D2->M}b$ [LL,UL]	$\theta_{D3->M}b$ [LL,UL]	$\theta_{D4->M}b$ [LL,UL]
White, not Hispanic/Latino boy	.001 [-.01, .01]	-.001 [-.01, .00]	.00 [-.01, .01]	.00 [-.01, .01]
White, not Hispanic/Latina girl	-.004 [-.02, .01]	-.003 [-.01, .01]	-.00 [-.01, .01]	-.00 [-.02, .01]
White, Hispanic/Latino boy	.001 [-.01, .02]	-.001 [-.01, .01]	.00 [-.01, .02]	.00 [-.01, .02]
White, Hispanic/Latino girl	-.002 [-.02, .01]	-.002 [-.02, .01]	-.00 [-.02, .01]	-.00 [-.01, .01]
Black boy	-.01 [-.05, .02]	-.01 [-.05, .02]	-.01 [-.06, .03]	-.01 [-.04, .02]
Black girl	.003 [-.02, .03]	.003 [-.02, .03]	.01 [-.02, .04]	.00 [-.02, .03]

Note. $N = 4239$. SRO = school resource officer. SRO-Camera = School resource officer and camera. Metal detector+ = Metal detector alone or in the presence of any other SSM. $\theta_{DX->M}b$ represents the difference (θ) in students' grades (M**b*) for students without SSMs compared to students with the identified SSM (DX). D1 = SRO only. D2 = SRO and Camera. D3 = Camera only. D4 = Metal detector alone or in the presence of any other type of SSM. M = Sense of safety. $b = .02$ and represents the effect of safety on academic achievement when presence of SSMs is held constant. Relative conditional indirect effects were calculated by multiplying relative conditional effects (Table 7) by $b_{\text{Sense of safety}}$ (Table 6). Bootstrap confidence intervals were conducted to determine whether the conditional indirect effects were significantly different from zero. LL = Lower level confidence interval. UL = Upper level confidence interval. The relative conditional indirect effects were not significant.

[a] The effects in this model are referred to as *relative conditional indirect effects* because (1) the predictor variable, SSMs, is multicategorical (meaning the effect of SSMs on academic achievement is *relative to* the reference group of no SSMs), (2) the effect of SSMs on academic achievement is mediated by sense of safety (meaning the effect of SSMs on academic achievement is indirect), and (3) the first stage of the indirect effect is moderated by sociodemographic identity (meaning the effect of SSMs on academic achievement through sense of safety is also *conditioned by* sociodemographic identity).

Table 9

Index of Moderated Mediation

	Index [LL, UL]			
	SRO only	SRO and camera	Camera only	Metal detector alone or in the presence of any other type of SSM
White, not Hispanic/Latina girl	-.004 [-.03, .01]	-.002 [-.01, .01]	-.003 [-.02, .01]	-.003 [-.02, .01]
White, Hispanic/Latino boy	.001 [-.01, .02]	-.000 [-.01, .01]	.000 [-.01, .01]	.002 [-.01, .02]
White, Hispanic/Latino girl	-.003 [-.03, .01]	-.001 [-.02, .01]	-.002 [-.02, .01]	.001 [-.01, .01]
Black boy	-.01 [-.05, .03]	-.01 [-.05, .02]	-.01 [-.06, .03]	-.01 [-.04, .02]
Black girl	.002 [-.02, .03]	.004 [-.02, .03]	.005 [-.02, .04]	.002 [-.02, .03]

Note. $N = 4239$. SRO = School resource officer. SRO-Camera = School resource officer and camera. Metal detector+ = Metal detector alone or in the presence of any other SSM. The index of moderated mediation shows the indirect effect of the presence of school security measures (SSMs) on academic achievement through students' sense of safety moderated by sociodemographic identity. A bootstrap confidence interval that does not include zero would indicate that the indirect effect is moderated by sociodemographic identity. All of the confidence intervals include zero, suggesting that sociodemographic identity does not moderate the relationship between SSMs and academic achievement through sense of safety.

Table 10

Summary of Study Results

Hypothesis	Additional Explanation
Are combinations of visible SSMs directly and negatively associated with academic achievement?	Not supported. The presence of visible SSMs were not associated with academic achievement.
Do students' perceptions of safety mediate the relationship between visible SSMs and academic achievement?	Not supported. The presence of visible SSMs were not associated with students' perceptions of safety. Students' perceptions of safety were not associated with academic achievement.
Does sociodemographic identity moderate the relationship between visible SSMs and perceptions of safety?	Partially supported. When no SSMs were present, Black boys felt significantly safer than White, not Hispanic/Latino boys. In the presence of any pattern of SSMs as compared to no SSMs, Black boys felt less safe. There was a significant, negative interaction such that the presence of SSMs was more pronounced for Black boys' sense of safety as compared to White, not Hispanic/Latino boys' sense of safety. In the presence of SROs only, SROs and cameras, and metaldetectors alone or with any other type of SSM, White, not Hispanic/Latina girls felt less safe than in the presence of no SSMs.

Figure 1

Hypothesized, Negative Association Between Visible SSMs and Academic Achievement

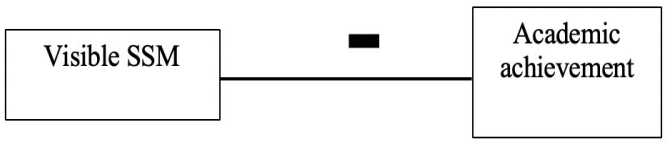


Figure 2

Hypothesized Mediation Model

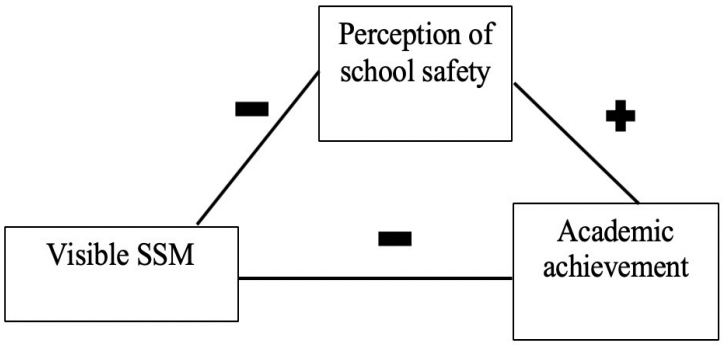


Figure 3

Hypothesized Moderation Model

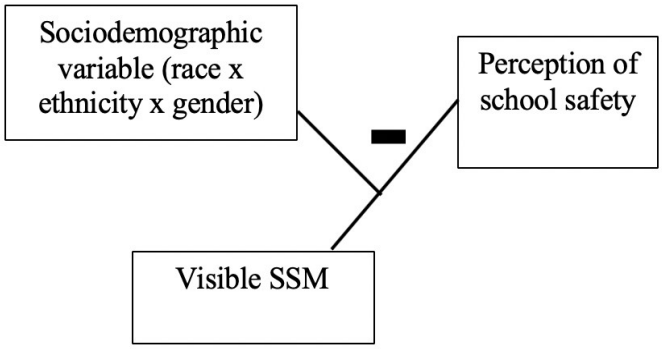


Figure 4

Hypothesized Moderated-Mediation Model

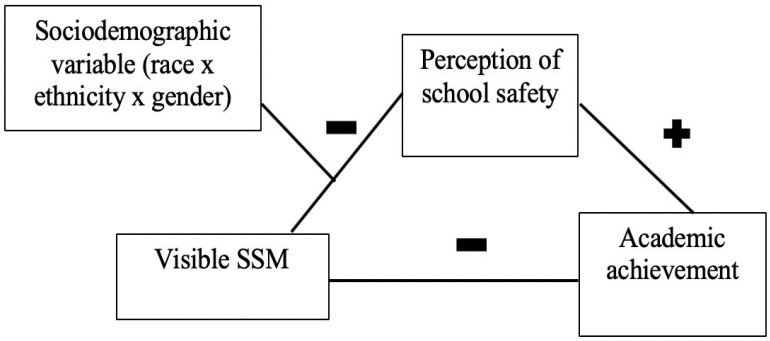
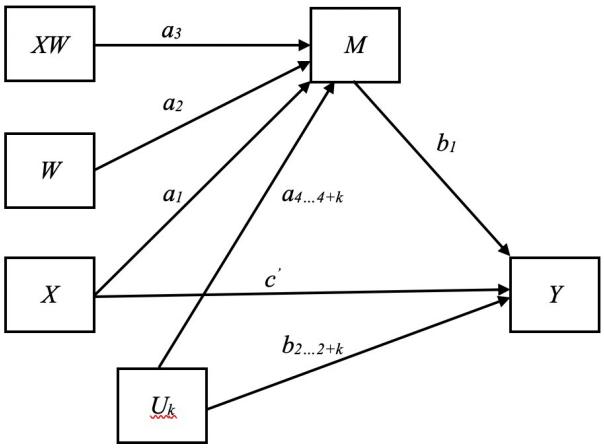


Figure 5

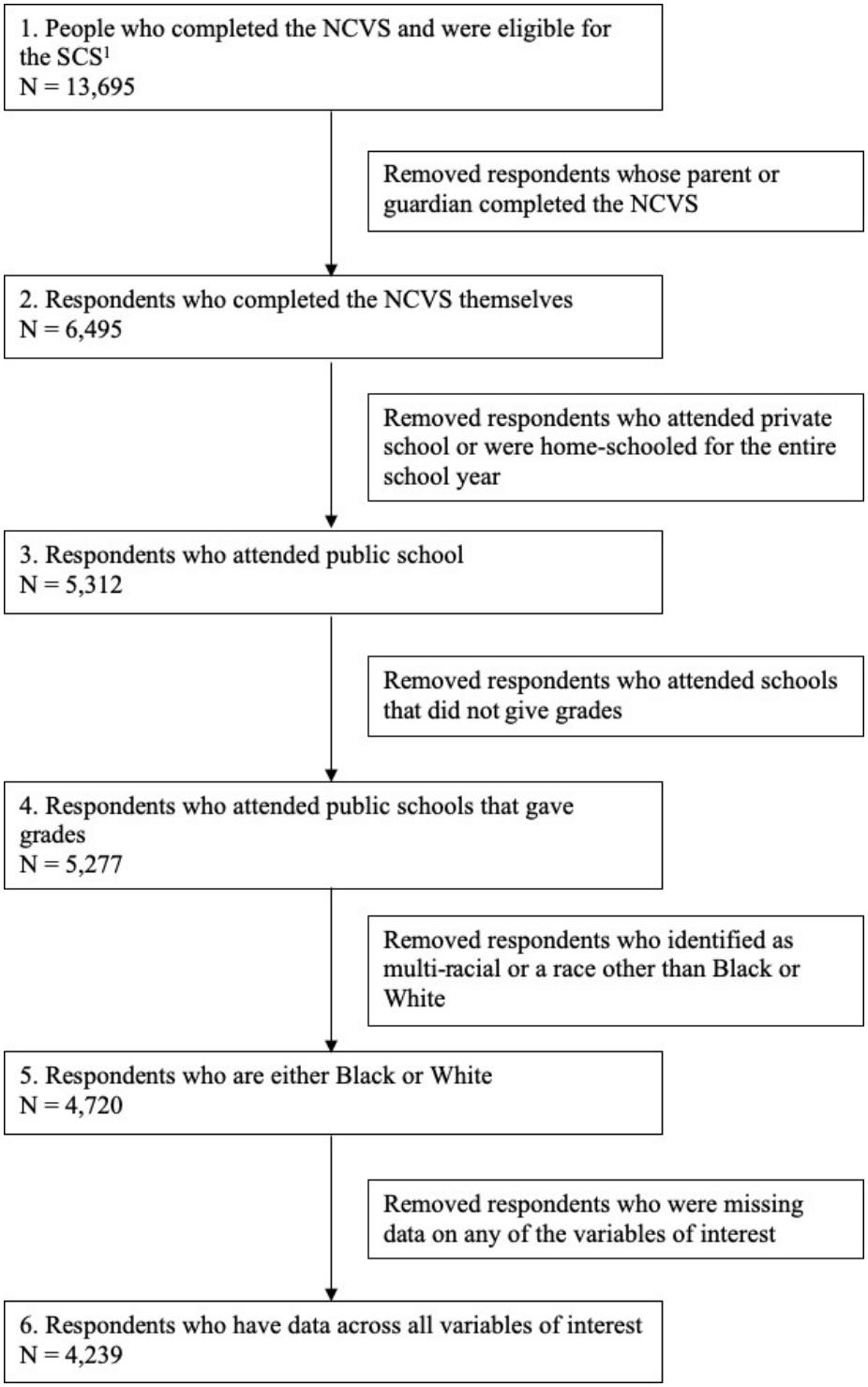
A Path Diagram of the Conditional Process Model



Note. X = visible SSMs, the predictor; W = sociodemographic variable, the moderator; XW = the interaction between the predictor and moderator; M = perceptions of school safety, the mediator; U_k = control variables, up to k; Y = academic achievement, the outcome variable.

Figure 6

Flow Chart of Survey Sample to Participant Sample



Note. NCVS = National Crime and Victimization Survey. SCS = School Crime Supplement.

[1]The SCS is a supplement to the NCVS and is administered every two years. See Appendix A for more information about the sampling procedure used for the NCVS and SCS.

Appendix A: SCS and NCVS sampling process

Every two years, the Bureau of Justice Statistics (BJS) and the National Center for Education Statistics (NCES) collect the data available in the SCS, as part of the data collection which occurs annually for the NCVS. Therefore, the sampling process used for the NCVS is the same sampling process used for the SCS.

First, primary sampling units (PSUs) consisting of large metropolitan areas, counties or groups of bordering counties across the United States are identified. Each PSU has at least 7,500 persons and is approximately 3,000 square miles. Then, PSUs are divided into sampling strata. PSUs which are within large Core Based Statistical Areas are considered self-representing PSUs, making up their own sampling strata, and are included in every sample. The remaining non-self-representing PSUs (NSR PSUs) are grouped within the same state with similar NSR PSUs to form strata. Once every 10 years, a sample of PSUs, which includes all of the SR PSUs and a subset of the NSR PSUs (sampled with probability proportional to the population size), is selected. From this sample, a random sample of housing units is selected. The sample of housing units is divided into six rotation groups, with each rotation group being interviewed every six months for three years (for a total of 7 interview visits per housing unit). Additionally, each rotation group is divided into six panels. A different panel is interviewed each month during every six-month period. For more information about the sampling process, see the SCS codebook (U.S. Bureau of Justice Statistics, 2017).

Appendix B: Characteristics for Key Study Subsamples

	M (*SD*) or % (*N*)			x^2	df
	Sample 1	Sample 2	Sample 3		
Age	14.9 (1.9)	14.9 (1.9)	14.9 (1.9)		
School level				96.27**	3
Primary	3.9% (207)	3.8% (179)	3.4% (144)		
Middle	30.6% (1614)	30.6% (1445)	31.5% (1337)		
High	59.0% (3111)	59.2% (2795)	60.0% (2545)		
Other	6.1% (321)	6.0% (281)	5.0% (213)		
Missing	0.5% (24)	0.2% (20)	N/A		
School enrollment				12.39*	5
Less than 300	7.7% (407)	8.0% (377)	8.5 (360)		
300-599	15.8% (835)	16.5% (780)	17.5 (743)		
600-999	23.6% (1247)	23.8% (1123)	25.0 (1059)		
1,000 -1,499	19.6% (1032)	19.3% (910)	20.0 (847)		
1,500-1,999	14.1% (743)	13.8% (653)	14.5 (614)		
2,000 or more	14.0% (740)	13.5% (636)	14.5 (616)		
Missing	5.2% (273)	5.1% (241)	N/A		
Race				1.81	1
Black	12.7% (641)	14.4% (679)	14.2% (600)		
White	76.8% (3862)	85.6% (4041)	85.8% (3639)		
Black-other	2.1% (104)	N/A	N/A		
White-other	1.9% (98)	N/A	N/A		
Other	6.5% (325)	N/A	N/A		
Hispanic/Latinx	25.4% (1341)	27.0% (1275)	26.8% (1135)	1.19	1
Male	50.1% (2646)	50.1% (2364)	50.0% (2119)	.16	1

Income					3.28	3
	<$25,000	17.5% (921)	17.7% (837)	17.6% (748)		
	$25,000 - 49,999	25.0% (1320)	24.7% (1168)	24.4% (1036)		
	$50,000 - 99,999	31.8% (1679)	32.1% (1514)	32.2% (1364)		
	>$100,000	25.7% (1357)	25.4% (1201)	25.7% (1091)		
SSMs					72.00**	7
	No SSMs	5.2% (275)	5.0% (234)	4.4% (185)		
	SRO only	7.1% (377)	7.0% (330)	7.0% (297)		
	Camera only	18.4% (969)	18.4% (868)	18.2% (772)		
	SRO-CAM	58.5 (3089)	58.8% (2774)	60.6% (2570)		
	MD+[a]	10.0% (529)	10.9% (514)	9.8% (415)		
	Missing	0.7% (38)	0.7% (34)	N/A		

Note. Sample 1 = SCS respondents of all races who met the inclusion criteria and have missing data (n = 5277). Sample 2 = SCS respondents who met the inclusion criteria, are Black or White, and have missing data (n = 4720). Sample 3 = SCS respondents who met the inclusion criteria, are Black or White, and have no missing data (N = 4239). The χ^2 analysis compares Sample 2 and Sample 3. SSM = School security measures. SRO = School resource officer. SRO-CAM = SRO and camera. MD+ = Metal detector alone or in the presence of any other type of SSMs.
[a] Preliminary data exploration showed that keeping the categories of metal detectors alone, metal detectors and SROs, metal detectors and cameras, and metal detectors SROs and cameras separate was very small compared to the entire sample. Therefore, these four groups were combined into one larger category, represented here.
*p < .05. **p < .01.

Appendix C: Imputed Mediation Model

Model	Variables	*b*[LL, UL]	SE
School environment			
	Relationships	.22** [.17, .27]	.03
	Crime	-.06** [-.19, -.12]	.15
	School rules	.06* [.05, .15]	.03
Individual characteristics			
	(School environment)	-	
	Income	.10** [.10, .15]	.01
	Fear of harm	-.14** [-.21, -.09]	.03
	Bullying	-.05** [-.07, -.03]	.01
	Age	-.02** [-.03, -.01]	.01
School demographics			
	(School environment)	-	
	(Individual characteristics)	-	
	% FRPM	-.08** [-.12, -.04]	.02
U.S. Region			
	(School environment)	-	
	(Individual characteristics)	-	
	(School demographics)		
	Northeast	.06 [.01, .18]	.04
	Midwest	-.04 [-.08, .03]	.02
	West	-.08** [-.12, -.02]	.02
SSMs			
	SRO only	-.11 [-.24, .02]	
	SRO-CAM	-.05 [-.15, 06]	

	CAM only	-.01 [-.12, .11]
	MD+	-.09 [-.23, .05]
Sense of safety		-.02 [-.02, .07]

Note. N = 4720. % FRPM = Free or reduced-price meals as the percent of school enrollment. SSMs = School security measures. SRO = School resource officer. SRO-CAM = SRO and camera. CAM only = Camera only. MD+ = Metal detector alone or in the presence of any other type of SSMs.
*$p < .05$. **$p < .01$.

Appendix D

Model	Variables	*b*[LL, UL]	SE
School environment			
	Relationships	.29** [.26, .32]	.02
	Crime	-.19** [-.21-, -.16]	.01
	School rules	.35* [.32, .38]	.02
Individual characteristics			
	(School environment)	-	
	Income	-.00 [-.02, .01]	.01
	Fear of harm	-.16** [-.20, -.13]	.02
	Bullying	-.02** [-.04, -.01]	.01
	Age	-.01* [-.01, .00]	
School demographics			
	(School environment)	-	
	(Individual characteristics)	-	
	% FRPM	-.02* [-.04, -.00]	.01
U.S. Region			
	(School environment)	-	
	(Individual characteristics)	-	
	(School demographics)		
	Northeast	.01 [-.05, .07]	.03
	Midwest	.04* [.00, .07]	.02
	West	.01 [-.04, .12]	.02
SSMs			
	SRO only	-.01 [-.13, .12]	.12
	SRO-CAM	-.08 [-.18, .02]	.11

	CAM only	-.04 [-.14, .07]	.12
	MD+	-.10† [-.22, .02]	.14
Sociodemographic identity			
	White, not Hispanic/Latina girl	.02 [-.12, .16]	.09
	White, Hispanic/Latino boy	-.07 [-.26, .12]	.14
	White, Hispanic/Latino girl	.00 [-.18, .18]	.09
	Black boy	.28† [-.03, .60]	.16
	Black girl	-.17 [-.52, .18]	.17
Interaction terms			
	SRO x White, not Hispanic/Latina girl	-.11 [-.29, .08]	.10
	SRO x White, Hispanic/Latino boy	.06 [-.17, .30]	.12
	SRO x White, Hispanic/Latina girl	-.16 [-.38, .06]	.11
	SRO x Black boy	-.34† [-.72, .04]	.19
	SRO x Black girl	.06 [-.34, .47]	.20
	SRO-CAM x White, not Hispanic/Latina girl	-.03 [-.17, .11]	.07
	SRO-CAM x White, Hispanic/Latino boy	.01 [-.19, .21]	.10
	SRO-CAM x White, Hispanic/Latina girl	-.07 [-.25, .11]	.09
	SRO-CAM x Black boy	-.30† [-.63, .03]	.16
	SRO-CAM x Black girl	.15 [-.21, .51]	.18
	CAM x White, not Hispanic/Latina girl	-.03 [-.19, .12]	.08
	CAM x White, Hispanic/Latino boy	.03 [-.18, .25]	.10

CAM x White, Hispanic/Latina girl	-.15 [-.36, .07]	.10
CAM x Black boy	-.32† [-.68, .05]	.18
CAM x Black girl	.13 [-.28, .54]	.20
MD+ x White, not Hispanic/Latina girl	-.09 [-.27, .10]	.09
MD+ x White, Hispanic/Latino boy	.18 [-.04, .41]	.11
MD+ x White, Hispanic/Latina girl	.03 [-.19, .26]	.11
MD+ x Black boy	-.20 [-.55, .15]	.17
MD+ x Black girl	.11 [-.26, .49]	.19

Note. $N = 4720$. % FRPM = Free or reduced-price meals as the percent of school enrollment. SSMs = School security measures. SRO = School resource officer. SRO-CAM = SRO and camera. CAM only = Camera only. MD+ = Metal detector alone or in the presence of any other type of SSMs.
†$p < .10$. *$p < .05$. **$p < .01$.