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# School Security Measures and Longitudinal Trends in Adolescents' Experiences of Victimization

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## Abstract

Although school security measures have become a common fixture in public schools across the United States, research on the relationship between security and adolescent victimization is mixed, with very few studies examining trends in adolescent victimization across time. Using two waves of data from the Educational Longitudinal Study 2002 ($N = 7659$; 50.6% female; 56.7% White, 13.3% Black, 13.5% Hispanic, 11.3% Asian American, 5.4% other race), results from a series of multi-level models demonstrate that adolescents in schools with more security measures report higher odds of being threatened with harm, and no difference in odds of being in a physical altercation or having something stolen over time. Although prior research has established racial disparities in using school security measures, results demonstrate inconsistent patterns in the extent to which adolescents' race conditions the relationship between security and victimization. The findings are discussed in light of existing theoretical and empirical work, and implications for both research and practice are offered.

**Keywords** School security · Victimization · Race · School safety

## Introduction

Schools are a critical location for the social development of adolescents (Eccles and Roeser 2011); accordingly, creating positive learning environments for adolescents is a major priority for practitioners, policymakers, and researchers alike. Unfortunately, many adolescents experience victimization at school such as being physically attacked, threatened, or stolen from. The most recent national estimates from 2015 indicate that among adolescents ages 12 to 18, there were approximately 841,000 incidents of theft and violent victimization at school, and 21% reported being bullied at school across the U.S. (Musu-Gillette et al. 2017).

Although experiencing victimization at school is a meaningful outcome on its own, it is also associated with a series of negative longer-term developmental consequences including poorer academic achievement and problems with internalizing and externalizing behaviors (Nakamoto and Schwartz 2010; Reijntjes et al. 2010, 2011; Ttofi et al. 2012). Additionally, research has found that youth who experience victimization report higher levels of depression and lower-self-esteem (Raskauskas 2010), and school-based victimization has been linked to increased odds of substance use during adolescence (Gilreath et al. 2013). All of these findings highlight that the effects of school victimization "are not temporary" (Poteat et al. 2014, p. 1241) and that victimization can significantly affect prosocial development as youth age into early adulthood and beyond. As a consequence of the negative impact of victimization on a variety of developmental outcomes, schools are faced with the important task of preventing adolescent victimization.

One strategy that schools have used to prevent victimization is the implementation of a variety of school security measures such as security cameras, requiring students and staff identification cards, security officers, and metal detectors. The presence of school security measures increased dramatically nationwide during the 1990's and 2000's in tandem with a movement toward zero-tolerance discipline policies catalyzed by the Gun Free Schools Act in

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1994; this trend has been referred to as the criminalization of schools (Casella 2003; Hirschfield 2008; Kupchik and Monahan 2006; Skiba and Rausch 2006). Although school security measures are intended to deter problem behavior in and around schools, and may therefore be expected to reduce victimization, existing theoretical literature suggests that they may instead have a criminogenic effect whereby they actually may increase victimization. Moreover, the existing empirical literature provides mixed findings. For instance, some studies have found that schools' use of multiple security measures is associated with increased rates of victimization (Schreck and Miller 2003; Tanner-Smith et al. 2017; Taylor 2010) while others have found the opposite (Gerlinger and Wo 2016). Given the mixed findings, it is possible that there is true heterogeneity in the effect of school security measures on victimization; security measures might influence the experiences of different types of students in different ways. For instance, Hirschfield (2010) suggests that there are racial differences in how and why certain school security measures are used, and school security measures may disproportionately affect students of color (Kupchik 2016, see also Ruck and Wortley 2002) in light of disparities in school discipline (e.g., Skiba et al. 2002) and the racialized pattern of school security measure utilization more broadly (Kupchik and Ward 2014; Mowen and Parker 2017; Steinka-Fry et al. 2016).

One methodological problem that much of the extant literature faces is that studies frequently rely on cross-sectional data that introduce questions about endogeneity; that is, they are unable to disentangle whether school security measures influence rates of victimization or whether rates of victimization influence the decision to implement school security measures. Using longitudinal data to examine differences in victimization over time is one promising alternative approach to this body of research. Modeling differences over time allows for the identification of trends in victimization following the implementation of school security measures, allaying some of the concerns about endogeneity. As such, the current study examines the relationship between schools' use of security measures and adolescents' experiences of victimization at school over time. It also examines whether there are differences by student race.

## Contrasting Theoretical Perspectives on School Security Measures and Victimization

Opportunity theories of crime based in rational actor models suggest that school security measures should reduce victimization. Within the broad umbrella of opportunity theories, routine activity theory posits that crime occurs when there is a motivated offender, a suitable target, and a lack of capable guardianship (Cohen and Felson 1979). Capable guardianship refers to people or objects that are able to protect against crime occurring because the potential offender judges the risk of detection to outweigh the potential benefits of committing the crime. In school settings, security measures may act as capable guardians because they impart a sense of surveillance and implicitly or explicitly communicate to students that their behaviors are monitored. For example, security cameras that constantly watch hallways may deter adolescents from victimizing others because they believe school authorities will see their behavior. From this perspective, using more school security measures should increase the perceived risk of detection and consequently reduce victimization.

Critical theoretical perspectives, on the other hand, suggest that school security measures may degrade the school environment and contribute to an increase in victimization via negative expectancy effects. That is, if the heavy use of school security measures leads adolescents to believe that their schools are dangerous places, they may also believe that their peers contribute to that sense of danger. Consequently, they may align their behaviors with their beliefs about their peers' behaviors and contribute to an increase in victimization. Moreover, heavily securitized schools may contribute to a sense of alienation and weakened social bonds (Devine 1996; Nolan 2011), thereby reducing the extent to which adolescents are invested in behaving in ways that conform to the school's expectations (Hirschi 1969).

Although these theoretical perspectives provide contrasting expectations about the effects of school security measures on victimization, other theorists have suggested that these effects may not be universal, and may instead vary systematically along racial lines. At a national level, most school security measures are more common in schools with larger proportions of non-white students (Musu-Gillette et al. 2017). Additionally, prior research has shown that black students are more likely to attend schools with more intensive patterns of school security measures (Steinka-Fry et al. 2016), and schools with larger proportions of black students are more likely to use more exclusive forms of school security (Kupchik and Ward 2014). Given these racial differences in the distribution of school security measures, it is similarly possible that their relationship with adolescent victimization may vary along racial lines as well. The racial threat hypothesis suggests, for example, that as the proportion of people of color in a given space begins to increase, efforts will be taken to maintain the status quo that largely functions to favor white people (Blalock 1967; Blumer 1958; Crawford et al. 1998; Liska 1992). In schools, this may take the form of implementing additional school security measures or stricter disciplinary policies as forms of social control that may be used to limit the power and agency of students of color (see also Mowen and Parker

2017). As such, the presence of security measures in schools may have a qualitatively different effect on white students than on students of color. To our knowledge, no research to date has investigated within-school differences in the relationship between school security measures and student victimization.

## Existing Literature on School Security Measures, Adolescent Development, and Victimization

Several studies have examined the extent to which schools' use of security measures is associated with outcomes related to adolescent victimization and other related developmental outcomes. In regard to the role of school security and developmental outcomes, research has shown that the use of some forms of security can contribute to decreases in academic performance (Tanner-Smith and Fisher 2016), decrease civic engagement later on in life (Kupchik and Catlaw 2015), and increase stress for children and adolescents (Kupchik 2016). In addition, Bracy (2011) found that the use of school security and strict discipline often resulted in feelings of powerlessness among students, and also contributed to increased levels of frustration and anger. Likewise, McEvoy and Welker (2000) highlight that the use of school security can erode the school climate and decrease bonds between school officials and students, thus promoting antisocial behavior. The use of school security measures can also affect family functioning; for example, Mowen (2017) demonstrates that security measures can contribute to decreases in the relationship quality between the child and the parent, and also decrease the parent's future expectations for their child. Although research on the implications of school security and developmental outcomes is limited, the research reviewed above demonstrates that school security has the potential to impact a variety of developmental experiences (e.g., stress, anxiety, and family relationships).

Regarding the relationship between school security and victimization, findings from these studies have largely been mixed. Some studies have found that school security measures are associated with lower levels of victimization. For example, one study found that adolescents attending schools with more security measures reported less relational bullying victimization (Gerlinger and Wo 2016). Similarly, another study found that having adults supervising the hallways was associated with less victimization, although there were no significant effects for other school security measures (Blosnich and Bossarte 2011). Other studies have shown consistently negative effects such that the presence of school security measures was associated with higher levels of victimization. For example, some studies have found that the use of more school security measures is associated with more exposure to drugs, fighting, and

property crime (Tanner-Smith et al. 2017), disorder, including personal attack and theft (Mayer and Leone 1999; Schreck and Miller 2003; Taylor 2010), and violence and weapon presence (Cuellar 2018; Nickerson and Martens 2008). Still other studies have had mixed findings, where some types of school security measures have a positive relationship with student victimization, others have a negative relationship, and others have no effect at all (Burrow and Apel 2008; Cheurprakobkit and Bartsch 2005; Crawford and Burns 2016; Jennings et al. 2011; Sevigny and Zhang 2016). As such, there is no consensus on whether, how, and the extent to which school security measures relate to adolescent victimization.

One reason for the inconsistent findings may be that there truly is heterogeneity in the relationship between school security measures and victimization based on race. Researchers have hypothesized that school security measures have different functions in schools with different racial compositions such that they serve a more exclusionary purpose in schools with larger proportions of students of color (Hirschfield 2010; Wacquant 2001). Although few studies have empirically assessed this hypothesis, there are some that lend it support. For example, one study found that schools using cameras and security personnel in tandem compared to schools using neither had higher suspension rates for fighting, particularly in schools with larger proportions of non-white students (Tanner-Smith et al. 2017). Similarly, Theriot (2009) found that students were arrested for assault and disorderly conduct at higher rates in schools that employed school resource officers, particularly when there was a larger proportion of economically disadvantaged students. Notably, not all relevant studies have had similar findings. One longitudinal study, for example, found that the relationship between implementing school resource officers and recorded crime in school was invariant across school racial composition (Na and Gottfredson 2013). Notably, all three of these studies have only examined race at the school-level; to our knowledge, no study has assessed whether racial differences within schools play a role in the relationship between school security measures and adolescent victimization.

In addition to the inconsistent findings in prior literature, these studies often face methodological limitations that limit what can be learned from the studies. Specifically, the use of cross-sectional data makes it difficult to identify whether the school security measures were present before any changes in victimization or they were placed in schools that already had certain levels of victimization. Additionally, it does not allow for the examination of victimization over time. To date, we are unaware of any studies that have examined the relationship between multiple school security measures and changes in adolescent victimization over time (although some have examined the effects of the

implementation of single school security measures; Devlin and Gottfredson 2017; Na and Gottfredson 2013). Using longitudinal data would be a useful step for modeling trends in adolescent victimization that may occur following the implementation of school security measures.

Additionally, prior studies are inconsistent in how they operationalize school security measures. Some studies use several individual items to assess their independent contributions to student victimization (e.g., Blosnich and Bossarte 2011; Cheurprakobkit and Bartsch 2005), others use additive scales (e.g., Gerlinger and Wo 2016), others use theoretical frameworks to group security measures (e.g., Burrow and Apel 2008; Cuellar 2018; Mayer and Leone 1999; Sevigny and Zhang 2016), and still others use empirical methods of identifying underlying constructs related to school security measures (e.g., Nickerson and Martens 2008). Although these different approaches serve useful purposes, they do not address in particular the extent to which a school's overall level of security relates to victimization. That is, studies that analyze the contribution of different components of school security do not provide an overall measure of school security. The use of additive scales does provide this information, but assumes that each school security measure contributes equally to the construct, an assumption that may not hold. Research linking schools' overall use of security measures to adolescent victimization is therefore currently lacking.

## Current Study

In light of the mixed findings on the relationship between school security and victimization as well as the literature on differing effects of school security along racial/ethnic lines, the goals of this research project are two-fold. First, given that the extant literature on the school security provides inconsistent evidence about effects on victimization, with some studies finding that security measures reduce some forms of victimization (e.g., Gerlinger and Wo 2016), increase victimization (e.g., Tanner-Smith et al. 2017), or have no effect (e.g., Crawford and Burns 2016), this study offers a methodological advancement by using longitudinal data to address the following research question: What is the relationship between a school's level of security and adolescents' experiences of victimization? Second, given the large body of research documenting racial inequality in the application of school security measures (e.g., Hirschfield, 2010; Skiba et al. 2002), we explore the extent to which adolescents' race/ethnicity might condition the relationship between school security and victimization. Specifically, through the use of cross-level interaction terms, our second research question asks: Does a school's level of security

relate to victimization between waves differently for black adolescents relative to white adolescents?

## Methods

### Data

Data for this project came from wave 1 (2002) and wave 2 (2004) of the 2002 Educational Longitudinal Study (ELS: 2002; see National Center for Education Statistics 2002). The ELS: 2002 data were collected by the Research Triangle Institute for the National Center for Education Statistics of the United States Department of Education. The overall objective of the ELS: 2002 project was: "…to monitor the transition of a national sample of young people as they progress from 10th grade through high school and on to postsecondary education and/or the world of work" (National Center for Education Statistics 2002: 7). Schools across the United States were randomly selected to participate in the survey. Then, 10th grade students within each selected school were randomly selected to complete survey questionnaires. As part of the sampling design, data were also collected from a school administrator (typically the principal), teachers, and a parent of the student. As panel data, wave 2 data were collected in 2004 when nearly all of the students originally sampled in 10th grade at wave 1 were in now 12th grade. In the current analysis, we drew our independent measures from wave 1 and our dependent measures, described in greater detail below, from wave 2.

It is important to note that although data were also collected from students in private schools, we concentrated on the public school sample. Additionally, although the ELS data include additional interview waves, wave 2 was the final wave of data collected when students were in school and because our variable of interest (school security, described in greater detail below) was present only at waves 1 and 2, we did not use the subsequent data. Overall, this sample comprised 10,866 students nested in 531 schools across the United States. As part of the sampling strategy of ELS: 2002, African-American and Asian-American students were oversampled to generate large enough sample sizes for meaningful analysis and statistical power. In order to account for the effect of this oversampling, the current project used sampling weights derived by the ELS from Census data. With weighting, this sample is representative of the 10th grade public school student population in the United States in 2002. The racial composition of the analytic sample was 56.7% white, 13.3% black, 13.5% Hispanic, 11.3% Asian American, and 5.4% other race and included 50.6% female students.

## Victimization

The dependent measures in the current study encompassed three separate forms of victimization. At both wave 1 as well as the follow-up wave in 2004, students were asked whether during the first semester or term of the current school year if someone threatened to hurt them at school, whether they were in a physical altercation at school, and if they something stolen from them at school. Possible response categories ranged along a 3-point scale (0 = never, 1 = once or twice, and 2 = more than twice). Each item was recoded into a binary item to capture any victimization (1 = yes, 0 = no). In the analysis, we used victimization at wave 2 as the outcome measure while controlling for the lagged effect of victimization at wave 1. Descriptive statistics for these measures, and all other measures included in the analysis, can be found in Table 1.

## School Security

To capture school security, we drew data from the ELS: 2002 interview as well as the school administrator interview. The ELS: 2002 onsite interview included a facilities checklist that included a section on school security measures. This checklist included whether or not the school had any use of a security guard, metal detector, closed circuit security cameras, the presence of fencing around the school, and/or a required check point for anyone entering or exiting the school grounds. In addition to the facilities checklist, the school administrator was asked if the school used random drug sniffing dog checks, random searches for contraband on students or lockers, random drug testing of students, required a strict dress code, required the use of clear book bags or backpacks, use of emergency buttons in the classroom, required students to pass through metal detecting wands, and/or if the school required students and faculty to display identification at all times.

As we note in the literature review, creating a measure that represents a school's level of security presents methodological challenges. An additive scale fails to account for the fact that some items are more common than others (e.g., metal detectors compared to a dress code); using single items does not capture the security environment as a whole; and grouping specific measures based on theory fails to account for important empirical patterns in security use (e.g., using metal detectors might be predicated on using security personnel). To overcome these limitations, we treated school security as a latent construct that has the advantage of having a more universal interpretation across a variety of items and populations. Treating security as a latent construct moves the focus from observed security measures to latent scores that capture a school's proclivity toward security (de Ayala 2009).

To create a school's proclivity toward security, we used the observed items outlined above and entered them into a series two parameter logistic models (2PLs; see Harris 1989). These models, a type of item-response theory model (IRT), are designed to estimate a latent trait (often called a proclivity or tendency) based on observed characteristics (de Ayala 2009; see also Osgood et al. 2002). This 2PL IRT-based approach carries the advantage of accounting for the fact that the use of some security measures is more difficult to implement than others (e.g., adopting metal detectors is likely more difficult than controlling access to the school grounds). Through the IRT estimation parameters, the schools' proclivity (or tendency) toward security measures captures the extent to which each school reports the use of each measure. This proclivity is a level 2 measure as it varies only between—and not within—schools. Higher values on the scale indicate a stronger preference for more security measures. Through examining the difficultly and discrimination of each item and revising the construct, items with discrimination values above 1.5 and difficulties above 2 were removed (see Harris 1989; see also de Ayala 2009, p. 101).[1] As a result, the final construct is constructed of: (a) controlled access to the school grounds, (b) metal detectors), (c) use of metal detecting wands), (d) use of a closed campus for lunch, (e) presence of drug sniffing dogs, (f) random security sweeps, (g) strict dress code, (h), required ID badges for faculty/staff, (i) security cameras to monitor students, (j) panic buttons in classrooms, and (k) presence of security guards. Descriptive statistics for this measure—designed to have a mean of 0 and a standard deviation of 1—are presented in Table 2.

### Perceptions of safety

To control for the influence of student perceptions of safety, we included a measure that asked students the extent to which they did not feel safe at school. Response categories followed a Likert-type scale (1 = strongly agree, 4 = strongly disagree). This item was coded such that higher values indicated better perceptions of safety. This measure ranged from 1 (low perceptions of safety) to 4 (high perceptions of safety).

### Perceptions of problem behaviors

To account for student perceptions of problem behavior within the school, we used three separate measures that

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[1] Fitting a 2PL, and assessing model fit using discrimination and difficulty parameters, is explained in depth in de Ayala 2009 (p. 99-103). In brief, these two related parameters capture the extent to which each item is difficult (i.e. the ability for schools to "succeed" in having the security measure), and discriminatory (i.e. the extent to which items vary from very low to very high values on the latent trait). Items fit the 2PL model when they range up to 2.5 (see de Ayala 2009, p. 101).

**Table 1** Summary Statistics of the Educational Longitudinal Survey: 2002

| Wave 1 | | | | Wave 2 | | |
|---|---|---|---|---|---|---|
| Variable | M | SD | Range | M | SD | Range |
| Victimization | | | | | | |
| Threatened with harm | 0.219 | 0.413 | 0, 1 | 0.148 | 0.354 | 0, 1 |
| Physical altercation | 0.201 | 0.404 | 0, 1 | 0.108 | 0.310 | 0, 1 |
| Something stolen | 0.393 | 0.489 | 0, 1 | 0.263 | 0.441 | 0, 1 |
| Focal independent measure | | | | | | |
| School security | 0.001 | 0.994 | −1.980 to 2.213 | – | – | – |
| Student-level control measures | | | | | | |
| Perceptions of safety | 3.201 | 0.729 | 1–4 | – | – | – |
| Disruptions occur | 2.505 | 0.824 | 1–4 | – | – | – |
| Misbehavior occurs | 2.590 | 0.789 | 1–4 | – | – | – |
| Teachers bully students | 1.879 | 0.695 | 1–4 | – | – | – |
| Bonds with teachers | 8.621 | 2.000 | 4–16 | – | – | – |
| In-school suspension | 0.128 | 0.334 | 0, 1 | – | – | – |
| Out-of-school suspension | 0.082 | 0.274 | 0, 1 | – | – | – |
| Race/ethnicity (White contrast) | | | | | | |
| White | 0.567 | 0.489 | 0, 1 | – | – | – |
| Black | 0.133 | 0.354 | 0, 1 | – | – | – |
| Hispanic | 0.135 | 0.364 | 0, 1 | – | – | – |
| Asian American | 0.113 | 0.308 | 0, 1 | – | – | – |
| Other race | 0.054 | 0.299 | 0, 1 | – | – | – |
| Gender (male contrast) | | | | | | |
| Female | 0.506 | 0.500 | 0, 1 | – | – | – |
| Male | 0.494 | 0.500 | 0, 1 | – | – | – |
| Family socioeconomic status | −0.071 | 0.720 | −2.110–1.810 | – | – | – |
| Parent's marital status (married contrast) | | | | | | |
| Married | 0.770 | 0.421 | 0, 1 | – | – | – |
| Single | 0.046 | 0.209 | 0, 1 | – | – | – |
| Divorced | 0.119 | 0.323 | 0, 1 | – | – | – |
| Separated | 0.062 | 0.245 | 0, 1 | – | – | – |
| School-level control measures | | | | | | |
| Neighborhood safety | 1.525 | 0.866 | 1–4 | – | – | – |
| School delinquency | 28.899 | 5.317 | 19–51 | – | – | – |
| School type (suburban contrast) | | | | | | |
| Suburban | 0.508 | 0.499 | 0, 1 | – | – | – |
| Urban | 0.266 | 0.442 | 0, 1 | – | – | – |
| Rural | 0.227 | 0.419 | 0, 1 | – | – | – |
| Geographic location (midwest contrast) | | | | | | |
| Midwest | 0.244 | 0.430 | 0, 1 | – | – | – |
| Northeast | 0.168 | 0.374 | 0, 1 | – | – | – |
| West | 0.206 | 0.405 | 0, 1 | – | – | – |
| South | 0.381 | 0.386 | 0, 1 | – | – | – |
| % Free/reduced lunch | 3.693 | 1.803 | 1–7 | – | – | – |
| School size | 3.824 | 1.781 | 1–7 | | | |

*Note*: N = 7695 adolescents in 531 schools

*M* mean, *SD* standard deviation

**Table 2** Two parameter logistic item response theory results for school security measures

| Security measure | Coef. | SE |
|---|---|---|
| Control access to school grounds | | |
| Discrimination | 0.532 | 0.030*** |
| Difficulty | 0.405 | 0.046*** |
| Metal detectors | | |
| Discrimination | 1.175 | 0.110*** |
| Difficulty | 1.382 | 0.111*** |
| Use of metal detecting wands | | |
| Discrimination | 1.098 | 0.089*** |
| Difficulty | 1.248 | 0.050*** |
| Closed campus for lunch | | |
| Discrimination | 0.857 | 0.043*** |
| Difficulty | −1.097 | 0.052*** |
| Drug sniffing dogs | | |
| Discrimination | 0.418 | 0.031*** |
| Difficulty | −0.090 | 0.051*** |
| Random security sweeps | | |
| Discrimination | 0.701 | 0.041*** |
| Difficulty | 1.552 | 0.084*** |
| Strict dress code | | |
| Discrimination | 0.745 | 0.035*** |
| Difficulty | 0.071 | 0.031*** |
| Require ID badges for faculty/staff | | |
| Discrimination | 1.208 | 0.058*** |
| Difficulty | 0.230 | 0.022*** |
| Security cameras | | |
| Discrimination | 0.739 | 0.033*** |
| Difficulty | −0.086 | 0.031*** |
| Panic buttons in classroom | | |
| Discrimination | 0.345 | 0.028*** |
| Difficulty | −1.203 | 0.112*** |
| Security guards | | |
| Discrimination | 0.563 | 0.041*** |
| Difficulty | −1.265 | 0.076*** |

*Note*: $N = 7659$ adolescents in 531 schools

*Coef.* coefficient, *SE* standard error

***$p < .001$

capture the extent to which students believe (a) disruptions get in the way of learning, (b) misbehaving students get away with it, and (c) teachers bully students. Each item was scored along a four-point Likert-type scale (strongly disagree, disagree, agree, strongly agree) with higher values indicating worse perceptions.

### Bonds with teachers

To account for the influence of student bonds with the teachers, we drew data from four questions assessed along a Likert-type scale (strongly disagree, disagree, agree, strongly agree) that asked how much the student believed that: (a) students get along well with teachers, (b) the teaching is good, (c) teachers are interested in students, and (d) teachers praise student efforts. Items were coded such that higher values indicate a more positive orientation and then summed to create a scale of *bonds with teachers*. Cronbach's alpha of this measure (.77) indicates an acceptable level of inter-item reliability.

### In-school suspension

To account for the influence of school discipline, we first included a measure asking the student if they had received an in-school suspension. Possible responses followed along a 4-point scale (0 = never, 1 = 1–2 times; 2 = 3–6 times; 3 = 7–9 times; and 4 = 10 or more times). As very few students reported receiving an in-school suspension more than two times, we created a binary measure indicating whether the student had received an in-school suspension at all (in contrast to never having been suspended in-school).

### Out-of-school suspension

Similar to the measure above, we accounted for the influence of out-of-school suspensions. Responses followed along the same 4-point scale as the above measure (0 = never, 1 = 1–2 times; 2 = 3–6 times; 3 = 7–9 times; and 4 = 10 or more times). This item was coded into a binary measure capturing those who had received an out-of-school suspension (in contrast to those who had never received an out-of-school suspension).

### Socioeconomic status

To capture social class, we used a standardized socioeconomic status composite measure based on equally weighted measures of the father's/guardian's education, mother's/guardian's education, mother's occupational prestige score, father's occupational prestige score, and total family wealth. Additionally, we included control measures that captured the marital status of the parent. In the analysis, we withheld married in contrast to single, divorced, or separated. Finally, we also included a dummy variable indicating that the student was female in contrast to male.

### School delinquency

To account for school delinquency rates, the school administrator was asked a series of questions about delinquency within the schools, listed below and measured along a 5-point scale (1 = never happens, 2 = happens on occasion, 3 = happens at least once a month, 4 = happens at

least once and week, 5 = happens daily). Variables used to construct this measure included how often each is an issue in the school: class cutting, vandalism, use of illegal drugs, use of alcohol, possession of weapons, physical abuse of teachers, student bullying, verbal abuse of teachers, disorder in the classrooms, student disrespect for teachers, gang activity, physical conflicts, and student use of drugs/alcohol. These 13 items were coded such that higher values represent greater frequency of negative behaviors within the school, and summed. This composite index had a Cronbach alpha of .85, suggesting a high level of inter-item reliability.

### Perceived neighborhood safety

In addition to school delinquency, neighborhood safety may also relate to the use of security measures as well as student victimization. To account for this influence, we use data from a question that asked the administrator how safe they perceived the neighborhood to be. Possible responses followed a four-point scale with higher values indicating the neighborhood was less safe.

### Urbanicity

To account for variations in school discipline and security by school location, we used a dummy variable in the analysis representing that the school was urban or rural in contrast to suburban.

### Geographic location

In addition to school urbanicity, we also included a control for the geographic location of the school by including binary measures indicating that the school was located in the northeast, west, or south in contrast to the midwest. These regions coincide with the four-level regions identified by the U.S. Census Bureau.

### Free/reduced price lunch

To account for the percent of the student body eligible for free/reduced price lunch (an indicator of family income), we use an ordinal measure collected by ELS researchers measured along a 7-point scale (1 = 0–5%, 2 = 6–10%, 3 = 11–20%, 4 = 21–30%, 5 = 31–50%, 6 = 51–75%, and 7 = 76–100%).

### School size

We also included controls for the size of the school. To account for school size, we used an ordinal variable collected by ELS researchers that measured school size along a 7-point scale (1 = 1–99 students, 2 = 100–199,

3 = 200–299, 4 = 300–399, 5 = 400–549, 6 = 550–699, and 7 = 700 or more students).

## Missing Data

As with most large scale-quantitative data sets, missing data are present in the ELS: 2002. For example, the free/reduced lunch variable was missing from 14 schools due to nonresponse. Specifically, some cases were missing at random, while others were due to partial completion (i.e., the respondent failed to complete that portion of the survey), and others were simply due to nonresponse. With pairwise deletion, the sample would have been reduced by approximately 30 percent. While there are a variety of methods to recover missing data, we used multiple imputation in Stata 14SE using chained equations (ICE, see Azur et al. 2011). ICE is generally preferable to other forms (such as multivariate normal models, or Markov-chained equations) as other forms assumes all variables are approximately normally distributed. As many of our measures—including the dependent variable—are binary, this assumption is violated; ICE overcomes this limitation to other methods as it can produce estimates for categorical measures and also use categorical measures to generate estimates for both categorical and continuous measures. To accomplish this, ICE matches variables with missing data to variables without missing data. Then, using the variance among these measures, ICE generates imputations by performing a series of chained univariate regressions. Using the results of these chained equations, missing data are imputed on a case-by-case basis using sampling weights using 30 imputations (see Royston and White 2011; White et al. 2011).

One important consideration when using imputation concerns the decision of whether or not to impute the dependent variable (see Von Hipple 2007 for an overview). Failure to include the dependent variable in the imputation models artificially reduces the variation between the dependent and independent variables, and thus, researchers may fail to find significant relationships. On the other hand, including cases in which the dependent variable was originally missing in the regression analysis artificially increases the variance between the independent variables and dependent measure and thus, may lead researchers to find significant relationships among the dependent and independent variables when none exists. Thus, following the recommendation of Von Hipple (2007), we included the dependent variables (victimization at wave 2) in the imputation analysis (i.e., to create the imputed data), but dropped all cases in which the dependent variables were originally missing from the regression analysis. With the use of imputation, the total sample size encompassed 7659 adolescents nested in 531 schools.

## Analytic Strategy

Because of the sampling strategy used by ELS: 2002 in which students are nested in schools, the data violate the assumption of independence made by some forms of regression such as ordinary least squares. Specifically, students within a given school may be more similar to each other than students between schools (see Raudenbush and Bryk 2002). This effect, often referred to as a nesting or clustering, requires using multi-level modeling in which a random intercept is introduced that accounts for this clustering effect (Rabe-Hesketh and Skrondal 2012). Therefore, we use multi-level modeling in Stata 14SE by nesting students within schools. As our outcomes are binary, we use a generalized multi-level model (Rabe-Hesketh and Skrondal 2012). To address our second research question, we created a cross-level interaction encompassing student race (at level one) and school security (at level two, for an overview of creating interactions see Paccagnellla 2006). Beyond assessing the statistical significance of the interactions, we plotted and probed the interactions to identify simple slopes and regions of significance that aid in the interpretation of the results. First, we plotted simple slopes for each interaction with 95% confidence bands indicating the regions at which the interaction was statistically significant. Regions in which the 95% confidence bands did not include zero indicated that the interaction was statistically significant in that region, regardless of whether the overall interaction was statistically significant. Second, we plotted values of the dependent variable at different levels of school security (the mean value of the IRT score, and +/− one standard deviation from the mean IRT score) and race (white or black). These graphs provide substantive information about the magnitude of the interaction in practical terms. These figures were created using the online utility provided by Preacher et al. (2006), which also provides more detailed information about plotting and probing interactions.

## Results

Results of the multilevel models are shown in Table 3, below. Results examining the odds of an adolescent being threatened with harm are shown in the first two columns of Table 3. For ease of interpretation, we use the logged odds ratios—an exponent of the log odds coefficient reported in Table 3 (see Rabe-Hesketh and Skrondal 2012). Perhaps unsurprisingly, the results first revealed that being threatened with harm at wave 1 was significantly related to the odds of being threatened with harm at wave 2. Results of the multivariate analysis revealed that school security measures were significantly associated with higher odds of an adolescent reporting to be threatened with harm.

Specifically, adolescents in schools with one standard deviation higher proclivity toward school security reported an 11.5% increase in the logged odds of being threatened with harm. Results for the control measures revealed that adolescents who had higher perceptions of school safety reported lower odds of being threatened with harm; adolescents who perceived that disruptions, misbehavior, and teacher bullying occurred with greater frequency reported significantly higher odds of being threatened with harm at wave 2. Similarly, adolescents who reported receiving an out-of-school suspension at wave 1 reported higher odds of being threatened with harm at wave 2 than adolescents who did not receive an out-of-school suspension.

In terms of race and ethnicity, Hispanic and Asian-American adolescents, relative to white adolescents, reported lower odds of being threatened with harm, but no significant difference was observed between white and black adolescents. Females, and those from higher socioeconomic status backgrounds, reported lower odds of being threatened with harm than their counterparts. At the school level, the only significant covariate was school urbanicity whereby adolescents in rural schools reported lower odds of being threatened with harm than adolescents in suburban schools. Cross-level interaction terms yielded null results suggesting that being black did not condition the relationship between a proclivity toward school security and being threatened with harm.[2] In fact, plotting and probing the interaction indicated that there were no regions of significance in the interaction (see Fig. 1); that is, at no level of school security did the relationship between a school's proclivity toward security and being threatened with harm differ between black and white adolescents.

Results examining the odds of being in a physical altercation are shown in the middle columns of Table 3. The results first demonstrate that adolescents who reported being in a physical altercation at wave 1 reported significantly higher odds of being in a physical altercation at wave 2 relative to adolescents who were not in a physical altercation at wave 1. Unlike the prior analysis, school security measures did not relate to the odds of being in a physical altercation. Similar to the prior model, adolescents who reported feeling safer reported lower odds of being in a physical altercation while adolescents who reported higher perceptions of misbehavior occurring within the school reported higher odds of being in a physical altercation. Adolescents who reported receiving an out-of-school suspension at wave 1 reported higher odds of being in a

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[2] We first ran the models with the main effects only, and then ran an additional model that added in the interaction terms. Results of the main effects in both models were substantively identical and, to save space, we present the main effects and interaction terms in one model.

**Table 3** Multi-level regression examining wave 2 victimization ($N = 7659$ adolescents in 531 schools)

| | Threatened with harm (W2) | | Physical altercation (W2) | | Something stolen (W2) | |
| --- | --- | --- | --- | --- | --- | --- |
| | Coef. | SE | Coef. | SE | Coef. | SE |
| Victimization | | | | | | |
| Threatened with harm (W1) | 1.277 | 0.073*** | – | – | – | – |
| Physical altercation (W1) | – | – | 1.406 | 0.085*** | – | – |
| Something stolen (W1) | – | – | – | – | 0.975 | 0.057*** |
| Focal independent measure | | | | | | |
| School security | 0.109 | 0.054* | 0.012 | 0.067 | 0.040 | 0.044 |
| Race/ethnicity and security interactions | | | | | | |
| Black × school security | −0.007 | 0.148 | −0.061 | 0.156 | 0.097 | 0.111 |
| Hispanic × school security | 0.015 | 0.009 | −0.006 | 0.010 | −0.006 | 0.007 |
| Asian American × school security | 0.044 | 0.161 | 0.169 | 0.180 | 0.162 | 0.118 |
| Other race × school security | 0.022 | 0.224 | 0.175 | 0.238 | 0.274 | 0.174 |
| Student-level control measures | | | | | | |
| Perceptions of safety | −0.202 | 0.051*** | −0.119 | 0.058* | −0.160 | 0.043*** |
| Disruptions occur | 0.117 | 0.056* | 0.070 | 0.052 | −0.008 | 0.037 |
| Misbehavior occurs | 0.127 | 0.049** | 0.125 | 0.056* | 0.097 | 0.040* |
| Teachers bully students | 0.136 | 0.055* | 0.034 | 0.064 | 0.036 | 0.045 |
| Bonds with teachers | 0.013 | 0.120 | 0.046 | 0.028 | 0.015 | 0.016 |
| In-school suspension | −0.233 | 0.124 | 0.045 | 0.130 | 0.035 | 0.098 |
| Out-of-school suspension | 0.547 | 0.137*** | 0.378 | 0.146* | 0.082 | 0.121 |
| Race/ethnicity (White contrast) | | | | | | |
| Black | −0.120 | 0.119 | 0.520 | 0.129*** | 0.378 | 0.091*** |
| Hispanic | −0.246 | 0.0122* | −0.013 | 0.144 | 0.133 | 0.096 |
| Asian American | −0.384 | 0.133** | −0.081 | 0.149 | 0.166 | 0.098 |
| Other race | −0.256 | 0.158 | 0.189 | 0.165 | 0.250 | 0.119* |
| Gender (male contrast) | | | | | | |
| Female | −0.431 | 0.070*** | −0.803 | 0.087*** | −0.261 | 0.055*** |
| Family socioeconomic status | −0.214 | 0.055*** | −0.14 | 0.064* | 0.043 | 0.041 |
| Parent's marital status (married contrast) | | | | | | |
| Single | 0.164 | 0.177 | 0.168 | 0.188 | 0.146 | 0.141 |
| Divorced | 0.152 | 0.109 | 0.016 | 0.137 | 0.139 | 0.091 |
| Separated | −0.094 | 0.170 | 0.132 | 0.179 | 0.080 | 0.128 |
| School-level control measures | | | | | | |
| Neighborhood safety | −0.060 | 0.054 | −0.025 | 0.063 | 0.038 | 0.039 |
| School delinquency | 0.001 | 0.009 | 0.002 | 0.010 | 0.003 | 0.007 |
| School type (suburban contrast) | | | | | | |
| Urban | 0.012 | 0.096 | −0.195 | 0.116 | −0.022 | 0.075 |
| Rural | −0.298 | 0.098** | −0.283 | 0.177* | −0.063 | 0.077 |
| Geographic location (midwest contrast) | | | | | | |
| Northeast | 0.153 | 0.111 | −0.131 | 0.137 | −0.099 | 0.093 |
| West | 0.075 | 0.119 | 0.091 | 0.139 | −0.028 | 0.094 |
| South | −0.054 | 0.098 | −0.169 | 0.117 | 0.070 | 0.077 |
| % Free/reduced lunch | −0.010 | 0.025 | −0.024 | 0.030 | −0.009 | 0.020 |
| School size | −0.004 | 0.028 | −0.045 | 0.034 | −0.001 | 0.022 |
| Constant | −2.119 | 0.420*** | −2.635 | 0.479*** | −1.517 | 0.336*** |
| Random variation (S.D.) | 0.207 | 0.099 | 0.337 | 0.085 | 0.164 | 0.076 |
| Rho | 0.013 | 0.012 | 0.033 | 0.016 | 0.008 | 0.007 |

*W1* wave 1, *W2* wave 2, *Coef.* coefficient, *SE* standard error

*$p \leq .05$, **$p \leq .01$, ***$p \leq .001$
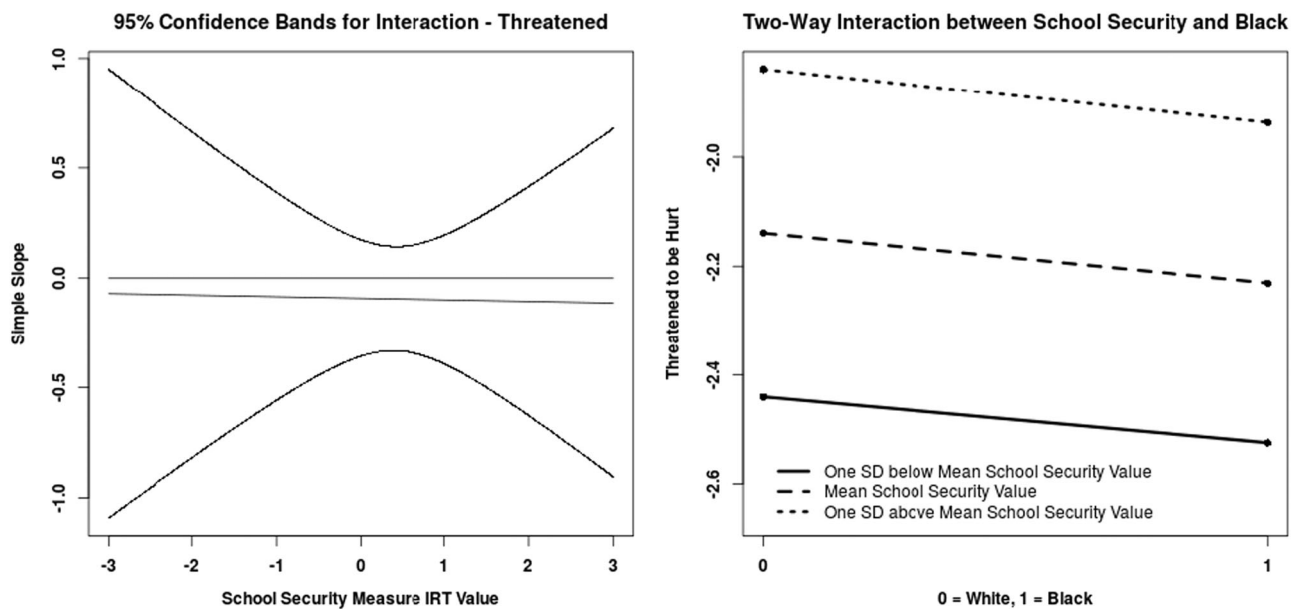
**Fig. 1** Confidence bands and simple slopes for the interaction between school security and Black predicting being threatened with harm

physical altercation than adolescents who did not report receiving an out-of-school suspension.

In terms of race and ethnicity, black adolescents reported significantly higher odds of being in a physical altercation than white adolescents, though no difference was observed between Asian-American, Hispanic, and other race adolescents compared to white adolescents. Like the prior analysis, females and adolescents from higher socioeconomic status backgrounds reported significantly lower odds of being in a physical altercation relative to their counterparts. Again, at the school-level, the only significant covariate was school urbanicity whereby adolescents in rural schools reported significantly lower odds of being in a physical altercation than those in suburban schools.

Like the prior model, the cross-level interaction between being black and the level of school security was not statistically significant. However, as shown in the left panel of Fig. 2, there were significant differences in the relationship between school security and being in a physical altercation between black and white adolescents when the IRT score for school security was between −1.66 and 1.53. This range encompasses the majority of the values for school security [−1.980, 2.213], suggesting that there were differences for black and white adolescents within the same school in the extent to which school security measures were associated with being in a physical altercation in schools with less extreme levels of school security—either high or low. As the right panel of Fig. 2 shows, black adolescents were consistently more likely than white adolescents to be involved in a physical altercation, and this difference was particularly pronounced in schools with lower levels of

school security. In schools with one standard deviation below the mean level of school security, black adolescents were 24% more likely to be involved in a physical altercation; in schools with one standard deviation above the mean level of school security, this difference was only 18%.

The model examining the odds of having something stolen is shown in the last section of Table 3. Results first reveal that having something stolen at wave 1 significantly related to the odds of having something stolen at wave 2. School security measures were not significantly associated with having something stolen at wave 2. Like model 2, results show that adolescents with higher perceptions of safety reported lower odds of having something stolen while adolescents who report higher perceptions that misbehavior occurs within the school reported significantly higher odds of having something stolen. Again, mirroring the results in model 2, black adolescents reported significantly higher odds of having something stolen relative to white adolescents. Female adolescents, relative to males, reported significantly lower odds of having an item stolen. No school-level covariate reached statistical significance.

Again, similar to each prior model, the cross-level interactions capturing the joint effects of schools security and adolescent race/ethnicity failed to reach significance. However, as shown in left panel of Fig. 3, plotting and probing the interaction again revealed regions of significance. Specifically, the relationship between school security and being stolen from differed between black and white adolescents when the IRT score of school security ranged from −0.65 to 3.40. Notably, this range encompasses all values above the mean level of school security.
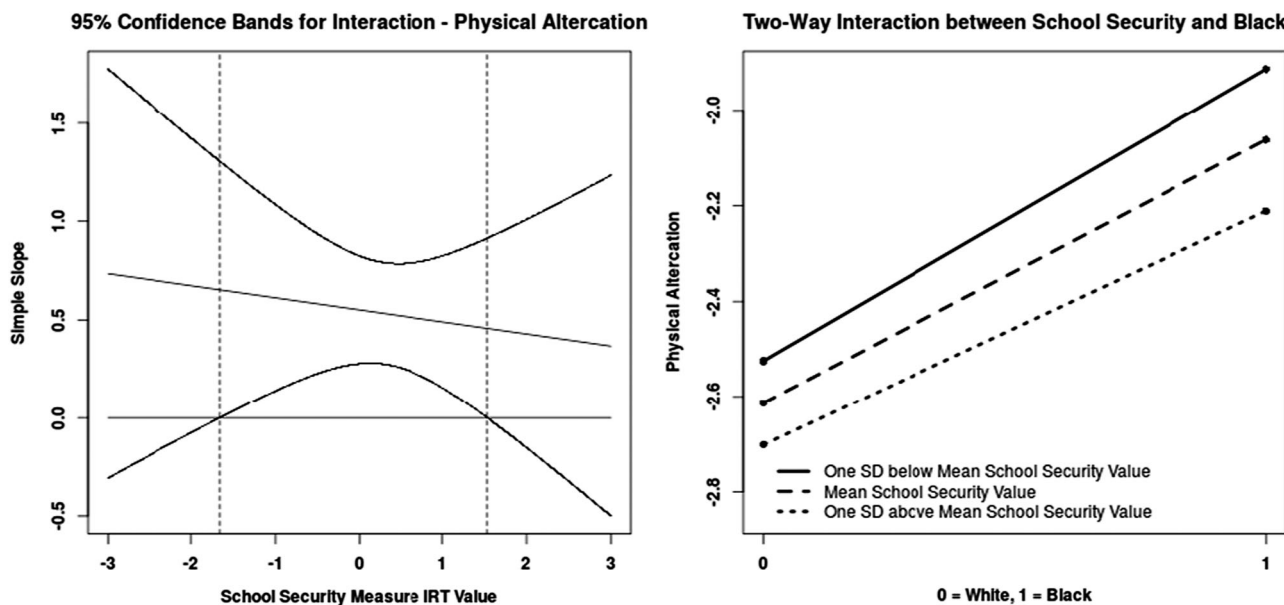
Fig. 2 Confidence bands and simple slopes for the interaction between school security and Black predicting being in a physical altercation
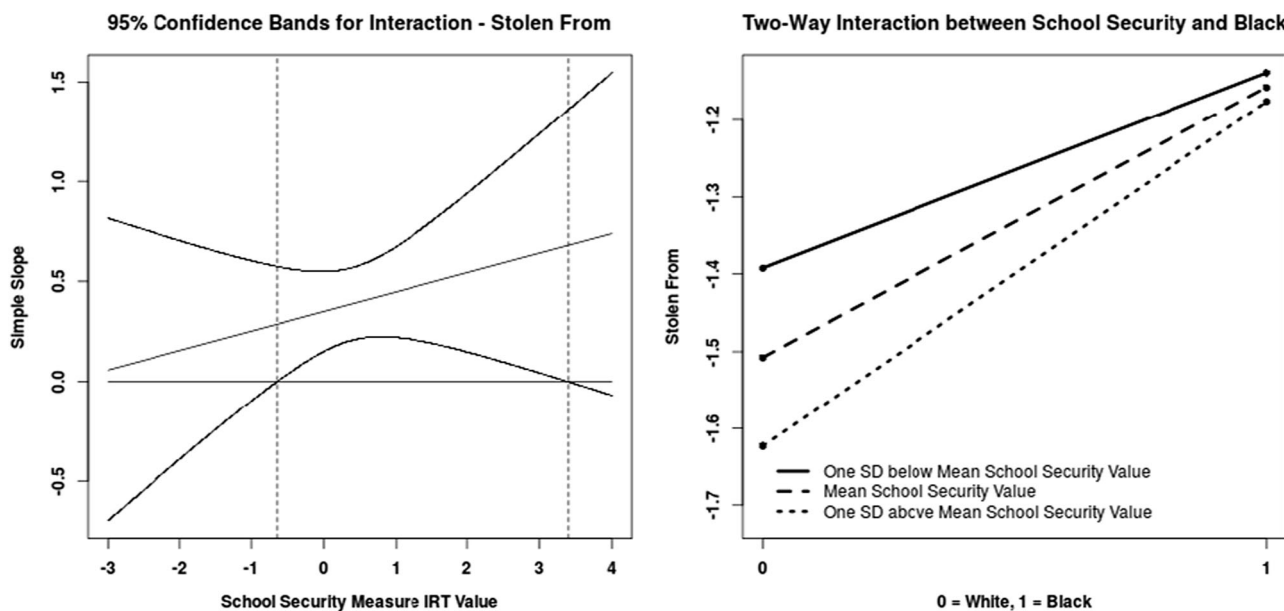


Fig. 3 Confidence bands and simple slopes for the interaction between school security and Black predicting being stolen from

As shown in the right panel of Fig. 3, there was a greater disparity in the relationship between school security and being stolen from between black and white adolescents in schools with higher levels of security. In schools with one standard deviation below the mean level of school security, black adolescents were 18% more likely than white adolescents to be stolen from; in schools with one standard deviation above the mean level of school security, this difference was 28%.

## Discussion

Although the majority of schools nationwide use multiple security measures (Steinka-Fry et al. 2016), the implications of school security measures for adolescent development are largely unknown. In particular, research on the relationship between school security and adolescent victimization is still evolving. Theoretical perspectives offer contrasting expectations about the direction of the relationship between

school security and adolescent victimization; some hypothesize that increased security should reduce victimization whereas others suggest that increased security should increase it. Moreover, existing empirical findings lend support to both of these hypotheses (e.g., Gerlinger and Wo 2016, Tanner-Smith et al. 2017). To further complicate matters, some scholars have suggested that race is an important consideration when assessing the effects of school security measures (Hirschfield 2010, Wacquant 2001). To date, much of the research on this topic has relied on cross-sectional data, thereby introducing concerns about endogeneity. That is, studies using cross-sectional data are unable to disentangle empirically whether school security measures were implemented in response to victimization rates, or whether victimization rates changed as a response to implementing school security measures. To address these concerns, the present study used nationally representative longitudinal data from adolescents to examine the change over time in victimization given a school's level of security measures. Additionally, it examined whether the relationship between school security measures and adolescent victimization differed systematically within schools based on race.

Overall, this study's findings provided mixed evidence about the relationship between school security and adolescent victimization. On one hand, a school's level of school security in 2002 was predictive of an increase of approximately 12% in the odds of being threatened with harm in 2004 while controlling for the 2002 levels of victimization and a series of potentially confounding variables. This relationship was significant despite an overall decrease in the rate of all types of victimization between 2002 and 2004 (see Table 1). School security was not significantly related to adolescents' other victimization experiences, including engaging in a physical altercation and having something stolen. One possible explanation for these findings is that school security measures may be useful for detecting and responding to more objective and visible behaviors such as fighting or stealing, whereas they may be less useful for instances of victimization that are more subjective and less visible such as being threatened. For instance, if one adolescent verbally threatened another with physical violence, but did not actually engage in any physical violence, school security measures may be an ineffective intervention.

When mapping these findings onto the contrasting theoretical frameworks, this study offered little support for opportunity theories that suggest school security measures may act as capable guardians in school spaces, reducing the amount of victimization that occurs (Cohen and Felson 1979). Instead, two of the three outcomes showed no relationship with school security measures and the third indicated that school security was related to higher rates of victimization. In fact, the significant positive relationship

between school security and being threatened provides some evidence in support of the perspective that higher levels of security may erode the school climate in such a way that adolescents are less likely to feel attached to the school and may engage in more victimizing behaviors (Devine 1996; Hirschi 1969). Unfortunately, the dataset contained no longitudinal data about school climate, so we were unable to directly test this hypothesis with these data. Interestingly, the only form of victimization associated with school security measures was one that appears least likely to be detectable by school security measures. This sort of adaptive behavior whereby students misbehave in ways that are undetectable by school security measures has been found in prior qualitative research examining behaviors around school security cameras (McCahill and Finn 2010; Weiss 2008). This pattern may indicate that school security measures can limit increases in clearer, more objective forms of victimization, but not more subtle, interpretable forms.

This study also found that schools' level of security had a different relationship with victimization depending on adolescents' race. Specifically, black adolescents were always more likely to be stolen from than white adolescents, but this relationship was stronger when schools had higher levels of security. On the contrary, however, although black adolescents were consistently more likely to be in a physical altercation than white adolescents, this difference was reduced in schools with higher levels of school security. Thus, this study finds that the relationship between school security measures and adolescent victimization is not consistent within schools, but varies by race. Prior research has primarily focused on between-school differences in relation to race, but these findings point to within-school effects as well. Given the inconsistency in the direction and magnitude of these interactions, more research is needed to understand why race mattered differently for each outcome variable. One possible explanation is that specific types of school security measures may have different effects on specific types of victimization (as in Tanner-Smith et al. 2017). For instance, perhaps security measures that focus on surveillance (e.g., security cameras, security guards) are more likely to prevent theft, whereas security measures that focus on maintaining order (e.g., strict dress code, closed campus for lunch) may be more useful for reducing physical altercations. These specific types of school security measures might relate differently to victimization for black and white students, a relationship that is obfuscated by our measure of an overall proclivity toward securitization.

Beyond its findings, this study offers two methodological contributions to the existing body of research on the effects of school security measures. First, this study's use of longitudinal data helps to address problems of endogeneity that have appeared in extant research. Because the outcome variables (i.e., victimization) were measured after the

measurement of school security measures, it is impossible to claim that the dependent variable caused the independent variable. Moreover, incorporating the level of victimization at the first time point allowed us to control for baseline levels of victimization. Second, using item-response models represents an improvement over other methods of measuring schools' overall use of security measures. Whereas scales or indices treat each school security measure as equally adding to a composite measure, item-response theory practices weight each item so that less common security measures contribute more to the measure than more common ones. Additionally, whereas various clustering techniques—both theoretical and empirical—have identified different substantive arrangements of school security measures that may exclude some forms of school security, item-response techniques use information from all security measures to give a sense of a school's overall level of security rather than the extent to which it might be reflective of a certain type or style of security. Thus, we see potential for item-response theory to be a useful method for characterizing a school's level of security in future research.

This study's findings may be useful for guiding schools' decision-making about implementing school security measures and addressing crime and misbehavior in schools in an effort to promote healthy adolescent development. Specifically, school security measures are not likely to be a one-size-fits-all approach to reducing misbehavior in general, and victimization in particular. The different patterns of relationships between school security and adolescent victimization that were found in this study are indicative of nuanced patterns in which the effects of school security measures vary by outcome type as well as by adolescent characteristics such as race. Prior research suggests that school characteristics are likely influential as well (Tanner-Smith et al. 2017). Therefore, schools ought to consider carefully whether the potential negative effects of school security measures—whether it is the financial cost, the increased prevalence of certain problem behaviors, the unequitable effects across different groups of adolescents, or something else—are worth the potential benefits that might ensue. Additionally, schools may benefit from clearly articulating the logic about how a specific security measure or set of security measures will influence the outcome they are trying to address. That is, if stealing is a major problem at a school, it would be worthwhile to articulate in detail how adding some sort of school security would logically be linked to reducing theft. Moreover, given the different patterns by student race across the different forms of victimization, schools ought to give particular attention to matters of racial equity in regard to school security measures. It would be worth gathering quantitative data on student crime, behavior, and victimization to assess whether there are differences by student race, as well as qualitative

data about how students of different races interact with the security measures differently. These context-specific data should be useful for providing school-specific guidance in creating a learning environment that is developmentally appropriate for students of all races. Although research on this topic is slowly developing, schools are faced with difficult choices that often need to be made immediately—although school security measures may sometimes be a useful intervention, they are far from a panacea.

As we note above, there is a considerable lack of literature on the link between school security and developmental outcomes among adolescents and emerging adults across time. Findings from this study help to address some of this gap in the developmental literature and contribute to existing research that—overall—suggests that high levels of security and punishment contribute to deleterious developmental outcomes (e.g., Kupchik and Catlaw 2015; Mowen and Brent 2016; Tanner-Smith and Fisher 2016). Specifically, this research complements a study by Mowen and Manierre (2017) that also used the ELS: 2002 data to examine the link between school security and extracurricular participation, finding that schools with high security had much lower levels of extracurricular participation. The authors argue that given the positive outcomes associated with many extracurricular activities during adolescence, school security measures may indirectly affect adolescents as they move into early adulthood. More directly, other research has shown that the use of punitive discipline—often a symptom of high security environments—relates to increased odds than an adolescent will experience an arrest, even when they remain in school (Mowen and Brent 2016) which may contribute to increased offending and victimization across time. Again, although limited, other research has shown that high levels of punishment and security can contribute to additional negative developmental outcomes including decreased participation in civic-engagement moving into emerging adulthood (Kupchik and Catlaw 2015) and poorer academic outcomes (Tanner-Smith and Fisher 2016). While more longitudinal research is needed, the current research on adolescent development and school security does not paint a positive portrait.

Although this study represents an advancement in the literature examining the effects of school security measures on adolescent victimization, its findings should be interpreted in light of its limitations. First, the data used for this study are from a single cohort of adolescents who were in 10th grade when first interviewed. It is unclear whether the findings generalize to adolescents in other grade levels. Second, the measures of victimization used in this study were limited to those asked in the interview at both waves; there are a variety of other forms of victimization that were not included that may or may not be related to schools' level

of security. Moreover, our measures of victimization were dichotomous indicators that did not assess the frequency of victimization. Although the ELS: 2002 data did include some measures of frequency, the ordinal scale that was used did not readily lend itself to data analysis. Nevertheless, future research should measure adolescent victimization in a more sensitive way than the dichotomous variable used here. Third, data about the school security measures was only collected at the first wave, thereby leaving unclear the extent to which any given school's use of security measures changed between the two waves of data collection. Any changes in the use of school security measures between the two waves may influence the relationships analyzed in this study. Future research may benefit from examining variability over time in schools' use of security measures and its relationship with victimization outcomes.

Fourth, the data used in this study are somewhat dated, having been collected in 2002 and 2004. There have been many changes in education and society more broadly since that time, so there may be some differences in the relationship between school security measures and victimization today. Nevertheless, schools do not look drastically different today than they did in 2002 regarding their use of school security measures. According to the most recent national estimates (Musu-Gillette et al. 2017), the percent of schools using any type of school security measure changed a negligible amount from 99.4% in 2001 to 99.8% in 2015. The largest changes have been in the use of security cameras (increasing from 38.5 to 82.5%) and locked doors (from 48.8 to 78.2%). Other measures—ones that are arguably more invasive—have remained fairly constant; the changes between 2001 and 2015 in the percent of schools using security personnel (from 63.6 to 69.5%), locker checks (from 53.5 to 52.9%), and metal detectors (from 8.7 to 12.3%) are all minimal, indicating that—although some important differences exist—the amount and type of school security measures used today are not entirely different from 2002. Fifth, the ELS data do not contain any measures that capture violence prevention programming within the school. This is an important limitation as prior work has found that schools who use violence prevention programs in schools tend to report better outcomes across a variety of violent and aggressive behaviors (Howard et al. 1999). Future research should examine the link between school security, violence prevention programming, and victimization.

## Conclusion

Although school security measures are a common intervention, the existing body of research addressing their effects on adolescent development in general and victimization in particular is limited by the use of cross-sectional data and measurement techniques that may not accurately or adequately capture a school's overall use of security measures. The current study addressed these limitations by using longitudinal data and a new way of measuring schools' overall use of security measures—item-response theory. This study's findings indicate that higher levels of security were related to increases over time in adolescents being threatened with harm, but were unrelated to involvement in physical altercations or being stolen from. Moreover, this study found that school security measures have a different relationship with victimization by race such that black adolescents had a higher likelihood of being stolen from than white adolescents, particularly in schools with higher levels of security, but experienced the opposite effect for being in a physical altercation. Given that promoting healthy development is a critical function of schools (Eccles and Roeser 2011), schools should carefully consider whether security measures are an effective use of funds.

## Compliance with Ethical Standards

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