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Metal Detectors and Feeling Safe at School

Billie Gastic[1]

Abstract

This article argues that metal detectors bestow an organizational stigma to schools. One symptom of this is students' heightened level of fear at school. Using data from the National Longitudinal Study of Adolescent Health (Add Health) and a matched-pair design, this study finds that metal detectors are negatively correlated with students' sense of safety at school, net of the level of violence at school. However, this association is different for urban students. The negative association between metal detectors and urban students' sense of safety is 13% less than what it is for students attending suburban or rural schools.

Keywords

metal detectors, school safety, school violence, Add Health

Metal detectors are one way that American public schools have chosen to manage the problem of weapons in schools. Despite the high financial costs associated with acquiring and operating metal detectors (Green, 1999), many school districts have been able to afford them by turning to state and Federal funds that have been set aside for investments in school safety (Ballard, 1998; Schreck & Miller, 2003). According to recent statistics, 6% of public schools are conducting daily or random metal detector searches of students. The majority of these schools are in urban areas. Ten percent of students aged 12

[1]University of Massachusetts, Boston

Corresponding Author:
Billie Gastic, Department of Public Policy and Public Affairs, John W. McCormack Graduate School of Policy Studies, University of Massachusetts Boston, 100 Morrissey Boulevard, McCormack Hall, 3-426, Boston, MA 02125
Email: billie.gastic@umb.edu

to 18 report the use of metal detectors at their schools (Dinkes, Kemp, & Baum, 2009).

There is no clear consensus on the nature of the effects or effectiveness of metal detectors in schools (Kitsantas, Ware, & Martinez-Arias, 2004). Metal detectors not only have been associated with reduced weapon-carrying in school (Ginsberg, 1993) but also positively correlated with other measures of school violence (Brown, 2005; Cheurprakobkit & Bartsch, 2005; Mayer & Leone, 1999). Other studies have found no correlation between metal detectors and school violence (Ginsberg, 1993; Schreck, Miller, & Gibson, 2003). Metal detectors have also been associated with students' fear at school (Gastic, 2006; McDonough, 2008; Schreck & Miller, 2003). Whether metal detectors may be associated with intensifying students' fear at school is important because such an effect has the potential to undermine schools' aims by unintentionally increasing (rather than decreasing) school violence.

The process by which this may happen can be described as a self-fulfilling prophecy (Merton, 1948) that is triggered by the organizational stigma (Devers, Dewett, Mishina, & Belsito, 2009) that metal detectors confer to public schools. Students may interpret the presence of a metal detector in their school as an indication that their school is unsafe (Ferraraccio, 1999; Schreck & Miller, 2003; Thompkins, 2000). In response, students may take preemptive steps to minimize their chances of victimization in what they now see as a risky school environment. Thus, fearful students may begin to exhibit behaviors that are common among victims of direct violence (Williams, Singh, & Singh, 1994). Unfortunately, such defensive behaviors, like carrying a weapon to school or joining a gang for protection, have been associated with increased students' fear and risk of harm (Thompkins, 2000; Wilcox, May, & Roberts, 2006). Thus, metal detectors set off a chain reaction in which students' efforts to keep themselves safe instead increase their risk of getting hurt.

The possibility that schools may be unintentionally increasing fear while trying to decrease violence through the use of metal detectors reminds us that students' feeling and being safe at school are both important but not always compatible goals (Twemlow, Fonagy, & Sacco, 2002). This study explores this issue and asks, "What is the relationship between the use of metal detectors and students' sense of safety at school?" This study also considers whether this relationship is different for students at urban schools, who are the most likely to be exposed to metal detectors at school. This study tests the hypothesis that urban students' sense of safety at school will be less affected by metal detectors than that of other students. Such a differential relationship

may be due to the reduction in the stigma that these students associate with metal detectors given the ubiquity of metal detectors in urban public schools.

Method

Data

The data are from the restricted-use contractual dataset of the National Longitudinal Study of Adolescent Health (Add Health), a nationally representative study of youth in Grades 7 through 12 (Udry, 2003). Its sampling design also yields a weighted sample that is nationally representative of schools with respect to region, urbanicity, type, size, and diversity of the student body (Harris et al., 2003). This study used survey data from Waves 1 and 2 (administered between 1994 and 1996). Add Health provides a unique opportunity to examine the relationship between the use of metal detectors and students' sense of safety without concern that such analysis will overlook the effects of several high-profile incidents of school violence. This is because such events (i.e., Paducah, KY, 1997; Columbine, CO, 1999; Red Lake, MN, 2005; Virginia Tech, 2007) occurred after data collection for Waves 1 and 2 of Add Health were already completed. As such, using Add Health data eliminates the concern that these analyses are not adequately dealing with such externalities.

Data come from the In-School Adolescent Questionnaire (Wave 1), In-Home Adolescent Questionnaires (Waves 1-2), School Administrator Questionnaires (Waves 1-2), and the School Information Survey. The School Information Survey contains general descriptive information about schools such as their location, size, and the demographic profile of their students, faculty, and staff.

Measures

Past studies have identified school and student characteristics that are correlated with the likelihood that students attend schools where metal detectors are used. For example, metal detectors are more likely to be found at public high schools that are majority-minority in terms of their student enrollment (Dinkes, Kemp, & Baum, 2009). Several of these covariates were used in this analysis. The student characteristics include race or ethnicity (indicator variables for African American, Latino, and White based on adolescents' self-identification) and sex (dichotomous, where 1 = *female*). The school characteristics are school location (dichotomous, where 1 = *urban*), school

level (dichotomous, where 1 = *high school*) and the level of school violence. The sample was limited to students attending public schools.

Consistent with other research using Add Health data, this study used school administrators' perceptions of school violence as a proxy for the level of school violence (Hoffmann & Dufur, 2008). The level of school violence was measured as the average response to a set of questions posed to school administrators (mostly principals). Principals were asked to describe a set of 10 common problems as either 1 (*not a problem*), 2 (*a small problem*), or 3 (*a big problem*) for their students. These problems included smoking or tobacco use, alcohol use, drug use, sexual harassment, teen pregnancy, eating disorders, stress and pressure, vandalism and theft, racial conflict, and gang violence for their school community (Cronbach's $\alpha = .86$). Purposefully retained were many of the items that are not typically included in such a measure (e.g., teen pregnancy, stress and pressure, and eating disorders) to yield a more inclusive measure of school violence. Such a measure is desirable since youth have been found to have a much broader understanding of threats to their safety than adults (Sheehan, Kim, & Galvin, 2004).

Two correlates of school violence were also used primarily to assess the comparability of the treatment and control groups with respect to school violence after matching cases. These are students' self-reported violent victimization and delinquency at school. Student victimization by violence was measured as the average response to six questions about students' exposure to violence (Cronbach's $\alpha = .70$). Students were asked how often, in the past 12 months, had they been in a physical fight, saw someone shoot or stab another person, had a knife or gun pulled on them or had been jumped, shot, cut, or stabbed (0 = *never*, 1 = *one or two times*, 2 = *three or four times*, and 3 = *five or more times*).

Student delinquency was measured as the average response to a set of questions used by researchers to measure delinquency using Add Health data (Cronbach's $\alpha = .84$; Demuth & Brown, 2004). Students were asked to indicate how frequently they engaged in a series of 10 delinquent activities over the past 12 months. Students described their involvement as either being 0 (*never*), 1 (*one or two times*), 2 (*three or four times*), or 3 (*five or more times*). These activities included deliberately damaging property that did not belong to them, taking something from a store without paying for it, stealing something worth more than US$50, stealing something worth less than US$50, going into a house to steal something, hurting someone badly enough to need bandages or medical attention, driving a car without the owner's permission, using or threatening to use a weapon to get something from someone, taking

part in a fight where a group of their friends was against another group, and acting loud, rowdy, or unruly in a public place.

The indicator variable of interest in this study is students' sense of safety at school. Students were asked to indicate on a 5-point scale how much they agreed with the statement "I feel safe at school." Higher values represent more positive feelings of safety at school (5 = *strongly agree*, 4 = *agree*, 3 = *neither agree nor disagree*, 2 = *disagree*, 1 = *strongly disagree*).

Data Analysis

It is desirable to use matched samples in correlational studies where the treatment and control groups have known strong covariates (Stuart, 2007). This describes the case of metal detectors in public schools (Dinkes, Kemp, & Baum, 2009). To draw the analytical sample, one-to-one matching (without replacement) was performed using the PSMATCH2 module in Stata (Leuven & Sianesi, n.d.). Each student in the "treatment" group (i.e., students who attended schools where metal detectors are used) was matched with a student in the "control" group that was comparable across several characteristics except for the fact that he or she attended a school that did not have metal detectors.

Cases were matched on the selected set of student and school characteristics: the students' race or ethnicity and sex as well as the urbanicity and grade level of, and level of violence at, the student's school. This process yielded an analytical sample of 7,618 cases. Given that each student in the treatment group was matched with a student in the control group, 50% of the sample (n = 3,809) consisted of students that attended schools where metal detectors were in use and 50% of students did not.

With matching completed, descriptive statistics for the analytical sample were calculated. Next, bivariate analyses were performed to examine the relationships between the school and student characteristics, students' sense of safety at school and the presence of metal detectors at school. Regression coefficients based on models of students' sense of safety at school that included the student and school covariates and the treatment variable (i.e., whether a metal detector was used at a student's school) were then estimated. The hypothesized interaction-association between metal detectors in urban schools on students' sense of school safety was also tested. Throughout, a p level of .05 was used. For each model, both unstandardized regression coefficients and standardized betas were computed. The standardized betas enable the comparison of the relative relationships between each of the variables and

students' sense of safety at school even though they are measured using different scales.

Although weights can be used with the Add Health data such that the analyses yield estimates that describe a nationally representative population of students (Chantala, 2003; Chantala & Tabor, 1999), these analyses were conducted on an unweighted sample given the alterations to the sample size that occurred after matching. As such, the analyses were performed on a national, but not nationally representative, sample of students. In other words, while the students in the analytical sample are drawn from all regions of the United States, they do not statistically represent the national population of youth in the manner made possible by the Add Health data research design.

Results

Table 1 displays descriptive statistics for both the full (unmatched) and analytical (matched) samples. Prior to matching, there were statistically significant differences between the treatment and control groups with respect to students' race or ethnicity and the level of violence at, and the location and level of, the students' schools. Students at schools where metal detectors were used attended schools with significantly higher levels of school violence than those students who attended schools without metal detectors. They were also significantly more likely to attend urban schools and high schools than were students at non–metal detector schools. African American and Latino students were significantly overrepresented among students at schools with metal detectors whereas White students were significantly underrepresented among students attending schools with metal detectors.

The matching procedure yielded an analytical sample where the treatment and control groups were more comparable across the covariates than before. After matching, the treatment and control groups were statistically indistinguishable in terms of the sex and minority status of the student. Matching also corrected for the previous dearth of students in the control group that attended urban schools and high schools. Thus, the matched sample brought more balance on those attributes. However, the level of violence at schools with metal detectors was still significantly higher than that at schools without metal detectors. This is indicative of the significant role that the level of school violence plays in the decision to install metal detectors in schools. However, the matching procedure did eliminate the differences between the treatment and control groups with respect to students' victimization and delinquency that existed in the full sample. This increased confidence that the matching procedure adequately increased the comparability of the treatment

Table 1. Descriptive Statistics of the Analytical (Matched) and Full (Unmatched) Samples

	Full (unmatched) sample			Analytical (matched) sample		
Variable	All students	Metal detector	No metal detector	All students	Metal detector	No metal detector
Student characteristics						
Female	0.51	0.50 NS	0.52	0.50	0.50 NS	0.51
African American	0.29	0.49***	0.22	0.51	0.49***	0.53
Latino	0.18	0.32***	0.13	0.30	0.32***	0.28
White	0.54	0.19***	0.66	0.19	0.19 NS	0.19
Victimization	0.17	0.20***	0.15	0.20	0.20 NS	0.19
Delinquency	0.28	0.29*	0.28	0.29	0.29 NS	0.29
Sense of safety at school	3.71	3.38***	3.80	3.53	3.38***	3.68
School characteristics						
Level of school violence	2.09	2.17***	2.06	2.13	2.17***	2.09
Urban school	0.27	0.33***	0.25	0.39	0.33***	0.46
High school	0.75	0.88***	0.71	0.85	0.88***	0.83
Unweighted *n*	15,128	3,809	11,319	7,618	3,809	3,809

*$p < .05$. **$p < .01$. ***$p < .001$.

Table 2. Estimated Coefficients From Regression Models of Students' Sense of Safety at School

	Model 1			Model 2			Model 3		
Variable	*b*		beta	*B*		Beta	*b*		beta
Student characteristics									
Female	−.03	(.02)	−.01	−.03	(.02)	−.01	−.03	(.02)	−.01
African American	.02	(.03)	.01	.01	(.03)	.00	.03	(.03)	.01
Latino	.01	(.04)	.00	.01	(.04)	.00	.02	(.04)	.01
School characteristics									
Level of school violence	−.26***	(.05)	−.07	−.18***	(.05)	−.05	−.22***	(.05)	−.06
High school	−.14***	(.04)	−.05	−.11***	(.03)	−.04	−.13***	(.04)	−.04
Urban school	.03	(.03)	.01	−.02	(.03)	−.01	−.12***	(.04)	−.05
Metal detector at school				−.28***	(.03)	−.13	−.36***	(.03)	−.17
Metal detector at urban school							.22***	(.05)	.08
Unweighted *n*	7,608			7,608			7,608		

*$p < .05$. **$p < .01$. ***$p < .001$.

and the control groups with respect to the level of school violence faced by students in each group.

The analytical sample consisted of 7,618 students. High school students accounted for 85% of the sample. Thirty-nine percent of students attended urban schools. The sample was balanced with respect to sex; 50% of students were female. There was also diversity by student's race or ethnicity: 51% of students were African American, 30% were Latino, and 19% were White. The average student attended a school whose principal described the level of school violence as "small" ($M = 2.13$, $SD = 0.28$).

On average, students were neutral-to-positive in their sense of safety at school ($M = 3.53$, $SD = 1.08$). Students at schools with metal detectors felt significantly less safe than students at schools without metal detectors (3.38 [1.10] vs. 3.68 [1.04]), $t(7{,}606) = 12.05$, $p < .001$. Table 2 presents the estimated coefficients from the regression models of students' sense of safety at school. There are three models shown. The first contains all of the student and school covariates. The second adds the treatment variable of whether a metal detector is present at the school. The third includes the interaction

variable to explore whether metal detectors have a differential relationship with urban students' sense of safety at school.

In the base model (Model 1), which consisted solely of the control variables, there was no detectable association of sex, race, or ethnicity or attending an urban school on students' sense of school safety. However, high school students were found to feel significantly less safe at school than middle school students. There was also a significant and negative relationship with the level of school violence; students attending more violent schools felt less safe at school than students at schools with lower levels of violence.

The treatment variable was added to Model 1 to yield Model 2. The relationships between each of the covariates and students' sense of safety at school were the same as in Model 1. There were no significant associations of sex, race, or ethnicity or attending an urban school on students' sense of school safety. The level of school violence and being a high school student were both significantly and negatively associated with students' sense of school safety. Most notably, students who attended schools that used metal detectors reported feeling significantly less safe at school than did other students, all else being equal. Attending a school that had a metal detector was the strongest predictor of students' sense of school safety (as determined by the standardized betas) than any of the other variables in the model.

Model 3 included an interaction variable that measured whether the association between metal detectors and urban students' sense of safety at school was significantly different than that between metal detectors and students' sense of safety for suburban or rural students. In this final model, students' sex, race, or ethnicity were not significantly associated with students' sense of safety at school. However, the school characteristics emerged as the most informative predictors. Students attending high schools felt significantly less safe than those attending middle schools. Urban students also reported feeling significantly less safe than suburban or rural students. The level of violence at one's school was also significantly and negatively related to students' sense of safety; students at schools with higher levels of violence reported feeling significantly less safe than their peers who attended schools with lower levels of violence.

Attending a school where metal detectors were in use was significantly and negatively associated with students' sense of safety at school, controlling for the set of student and school characteristics. In addition, the interaction variable in Model 3 was significant and positive. This means that the negative relationship between metal detectors and students' sense of safety at school was less for urban students than we would otherwise expect. Expressing this in terms of the unstandardized coefficients, the association of attending a

school where there was a metal detector on urban students' sense of safety at school would be measured as –.26 (= –.12 + –.36 + .22) instead of –.30 (= –.02 + –.28). In other words, the negative association between metal detectors and urban students' sense of school safety is 13% less than what we would otherwise expect.

Discussion

The use of metal detectors is significantly correlated with students' fear in schools. This link persists even after controlling for the level of violence at school. Metal detectors bestow an organizational stigma to schools of which one symptom is students' heightened level of fear in those schools. This may be due to how students interpret the use of metal detectors. Further studies of how students experience and think about metal detectors in their schools are needed. Students may describe their thoughts and feelings about being searched and seeing their friends and classmates searched and how that shapes their impressions of their school. Students may also be sensitive to what friends, family, community members, and others say about what having a metal detector at school means in terms of students' risk and safety.

The omnipresence of metal detectors in many urban school districts (e.g., School District of Philadelphia), however, has tempered their effect on urban students' fear at school. As metal detectors have unfortunately become a way of life for many urban students, they are less likely to be interpreted as a sign of more serious or unknown threats. This is not to say that urban schools generally and those that enroll large numbers of low income, African American and Latino students in particular, do not remain stigmatized as low quality. However, this stigma is not specifically due to whether there are metal detectors in place at those schools but rather due to their serving an urban student population.

As the stigma of metal detectors is diluted by the recognition of their use as common (e.g., the use of metal detectors in airports), one suggestion is to install metal detectors in all public schools. This would effectively eliminate the taint of metal detectors on students' sense of safety at school. However, this is neither desirable nor appropriate given the sheer cost of such a policy and the prudence of implementing safe school plans that suit the particular needs of individual schools. Despite their contribution to students' fear, this study does not propose the removal of metal detectors from all public schools. Metal detectors can be effective tools as part of an integrated strategy to keep weapons out of schools. However, this study does suggest the need to examine how decisions to introduce metal detectors to schools are communicated

to students, their families, and the surrounding community. Ideally, these stakeholders should be a part of the decision-making process; at the very least, they deserve to be informed about the reasons for the decision to bring metal detectors into their schools, how they will be used, for what purpose and by whom, and how (and by whom) the decision to eventually suspend the use of the metal detectors in their schools will be made, if at all.

Reasonable effort and resources should also be allocated to locate interventions that, unlike metal detectors, do not have residual negative effects on how safe students feel at school. The criteria and rubrics used to evaluate the effectiveness of safe school strategies should acknowledge dual aims of reducing risk to students while also protecting their sense of safety at school. Matching performance metrics with this expanded set of safety goals is essential.

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Bio

Billie Gastic, PhD, is an assistant professor at the Department of Public Policy and Public Affairs, John W. McCormack Graduate School of Policy Studies, University of Massachusetts Boston.