

Towards a Three-Dimensional Hardening of Schools to Promote Effective School Safety Practices in the United States: A Systematic Review

HaeDong Kim, PhD

Family Studies and Community Development
Towson University, Towson, MD

John S. Carlson, PhD

School Psychology, Michigan State University, East Lansing, MI

Sydney R. Nelson, LMSW

School Psychology, Michigan State University, East Lansing, MI

ABSTRACT

This article introduces a three-dimensional conceptual framework around approaches to promoting school safety practices in the United States. Our framework suggests school safety is maximized when three hardening dimensions are equally deployed – physical hardening (school’s environmental elements), procedural hardening (school’s policies and procedures), and psychological hardening (school’s strategies used to improve psychological wellbeing). A systematic review of the literature was completed and organized in the context of our three-dimensional framework to identify current hardening practices that have been empirically investigated. Among the 41 studies identified by our search criteria, 28 included physical hardening practices, 12 included procedural hardening practices, and 21 included psychological hardening practices. Few studies (n=8) included all three hardening practices within their efforts to promote school safety. The most commonly studied variables were school resource officers, locker checks, and clear and fair rules. Implications of this three-dimensional conceptual framework for future school safety research and policy directions in the United States are highlighted.

Key words: school safety, target hardening, school violence prevention, systematic review

INTRODUCTION

Creating a safe and secure environment free from violence is a necessary prerequisite to promote learning within school settings. Sadly, however, almost one in five students report not feeling safe in school¹ and nearly half of all children in the United States report being the victim of at least one form of school violence with intimidation (30%), victim of assault (14%), and witness to assault (13%) being the most frequent.² The rate of violence toward teachers in schools appears to be even higher.³ Three-quarters of teachers in the United States reported at least one instance of harassment (e.g., recipient of obscene remarks/gestures, being verbally threatened, targeted with intimidation), a quarter reported being physically attacked with no

need for medical care, and nearly 10% of teachers reported being physically attacked and in need of medical care. Violence in schools impacts students' ability to learn, teachers' ability to teach, and the community's perception about whether schools are a safe and supportive environment in which children can learn and develop.

In years leading up to the global pandemic, crimes against groups of individuals within schools in the form of mass school shootings in the United States added a substantial layer of concern for students, teachers, parents, and communities on top of other forms of school violence. In 2018, there were nine school shooting incidents in the United States (i.e., active shooter on school property) with 30 killed and 52 injured. This was the most school shootings in a 20-year period of analysis dating back to 1999.⁴ The Center for Homeland Defense and Security K-12 School Shooting Database indicates that over 1300 shootings have occurred since 1970 and that 97 shooting instances (i.e., gun brandished, fired, or a bullet hit school property regardless of victims, time, day of week, or reason) happened that same year, which is more than double the number seen in any given year since 2006.⁵ Thus, researchers investigating school gun violence urge new strategies be employed to mitigate and prevent these instances.⁶

A number of local, state, and federal initiatives are underway in the United States to promote school safety and reduce school violence including school shootings. One billion dollars has been pledged via the Students, Teachers, and Officers Preventing School Violence Act of 2018 (STOP).⁷ For a ten year period, \$100 million will be funneled to states in an effort to promote school safety initiatives. However, the predominant focus of these efforts appears to be focused on changes to the physical elements of school buildings and safety procedures. For example, the \$25 million given out to schools in Michigan in 2018 and 2019 (\$50 million total) via the state's Competitive School Safety Grant Program was allowed only for purchasing and installing technology and equipment for school buildings. More effective and comprehensive school violence prevention efforts and a reexamination of school safety practices are urgently needed especially in light of increased occurrences of school shootings despite the widespread adoption of bolstering physical security of school buildings.⁸

Numerous organizations and government agencies have generated reports to propose guidelines for interventions that may prevent or mitigate school violence (e.g.,^{7,9,10}). Some of the measures that have been proposed and/or implemented are, but not limited to, school resource officers (SROs), locks on doors, school entrance monitoring, security cameras, lockdown drills, active shooter response drills, arming school personnel, changes in gun regulations, and mental health screening. Further, national professional organizations have proposed a stronger integration of services in schools (e.g., academic, behavioral, social, emotional, mental health) through collaborative data-based problem solving within a public health prevention framework (i.e., multitiered system of support).⁹ While the proposals for preventing violence in schools may vary in specific measures, there is general agreement that interventions need to be comprehensive and multifaceted in order to bring meaningful change.

The purpose of this study was threefold: 1) to propose a conceptual framework that encompasses a diverse array of recommended and currently utilized school safety measures, 2) conduct a systematic review of the empirical literature across a diverse set of disciplines (e.g., education, psychology, criminal justice) and organize that literature within our conceptual framework to allow for a close examination of school-based safety measures that have been

studied or understudied, and 3) to provide directions for future research and policy regarding school violence prevention.

PROPOSED FRAMEWORK: THREE-DIMENSIONAL HARDENING

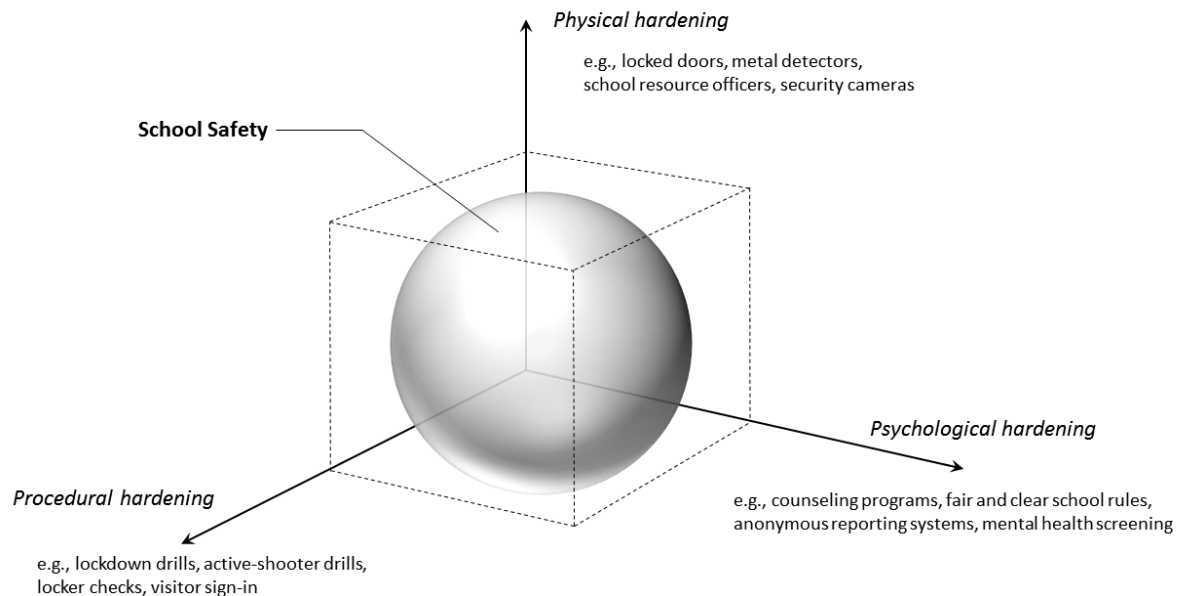
According to routine activity theory in criminology, an act of crime typically requires three elements: (1) an offender with the intent and ability to commit a crime; (2) a suitable target with value, physical visibility, access, and inertia; and (3) the lack of guardians to prevent the act of crime.¹¹ Any absence of these three elements may prevent or mitigate the crime. In this regard, target hardening is a method of preventing crimes by adding measures that can “harden” the target, such as door locks, surveillance cameras, and alarms. In an effort to make schools safer, schools have engaged in increased target hardening efforts over the years. For example, 81% of public schools reported using security cameras in 2015–16 compared to 19% in 1999–2000.¹²

Although the concept of target hardening has been typically used to indicate the implementation of physical security measures (e.g., locks and cameras), we propose the expansion of this concept in the context of promoting safety practices and school violence prevention approaches. The expansion of school target hardening can be illustrated as a three-dimensional (3D) framework that consists of physical hardening, procedural hardening, and psychological hardening. Physical hardening can be defined as changes made to the visible environmental elements of schools in order to increase or maintain safety. Examples of physical hardening include improving doors, windows, and locks; addition of perimeter and within building security cameras; use of metal detectors; hiring of school resource officers (SROs) and arming school personnel. Procedural hardening is defined as changes to the procedures or policies regarding school routines in order to increase or maintain safety. Examples of procedural hardening include implementing lockdown drills, visitor sign in/out procedures, locker checks, and active shooter response drills. Psychological hardening is defined as the strategies used to establish a culture that promotes the psychological well-being of all people in the school and, in turn, prevents violence while increasing school safety. Specifically, psychological hardening approaches focus on potential violent offenders (i.e., the first element of routine activity theory of criminology) to (a) prevent and/or reduce their violent intentions, (b) identify and diminish their obsession or rumination pertaining to harming others or themselves, and (c) intervene with and reduce their cognitive and behavioral capacity to commit an act of violence. Some examples of psychological hardening include mental health programs adopted to promote school safety, programs intended to increase student peer-relationships, fair and clear school rules, positive behavioral interventions and supports, restorative justice programs, anonymous reporting systems, and threat assessments.

In our 3D school hardening framework, school safety is conceptually maximized when there is balance among the three areas of hardening. To illustrate, we denote school safety as the maximum sphere that can fit within the space created by the three areas of hardening (see Figure 1). According to this framework, school safety cannot be increased by increasing one aspect of school hardening alone. For example, if a school disproportionately focused its resources on physical hardening measures, it would not result in the expansion of the sphere (i.e., school safety) in Figure 1; the three areas of hardening would merely create a space that is an elongated rectangular prism stretched along the physical hardening axis while the size of the sphere remains the same. For this school to increase school safety (i.e., expand the sphere),

additional resources would need to be invested in both procedural hardening and psychological hardening practices.

Figure 1.
Three-Dimensional School Hardening Framework



It is important to note that the proposed 3D school hardening conceptual framework is focused only on within-school safety measures. This is not to say that external and contextual factors such as community violence surrounding schools, gun access and laws, or family environment do not influence school safety. Numerous studies on school safety have taken these external factors into consideration.¹³⁻¹⁷ These factors fall outside the scope of our 3D school hardening framework which focuses exclusively on what school districts can do to promote school safety within their learning environments.

SYSTEMATIC LITERATURE REVIEW

Procedure

Eligibility criteria

In accordance with PRISMA guidelines for systematic reviews¹⁸, study selection eligibility criteria were established prior to searching online. The criteria used to select studies to be included in this systematic review included the following: (a) peer-reviewed journal articles published in English, (b) articles published between 1995 and 2019 to reflect research from the past 25 years, (c) studies that included samples of K-12 students, teachers, other school personnel from the United States, and (d) those studies that included quantitative methods to investigate the relationship between the use/presence of a school hardening measure of any of the three dimensions and a school safety related variable (e.g. perceived school safety, number of violent incidents reported, bullying). Studies that limited their samples to a specific demographic group (e.g., race, immigrant status, sexual orientation) were excluded. Studies based on qualitative interviews and focus groups were also excluded.

Information sources and search

Studies for the review were identified by searching electronic databases using the advanced search option on ProQuest online (<https://search.proquest.com/>). Three databases were used for the search: PsycInfo, ERIC, and Criminal Justice. The search terms were “school violence” or “school safety,” using quotation marks in order to request results only with the exact phrases and to ensure that the studies located were explicitly focused on promoting school safety or reducing school violence consistent with our three dimensional school hardening framework. While limiting the search to the eligibility criteria, the search terms were searched in abstracts, titles, subject areas, and keywords or the articles. The final search was conducted on October 24, 2019.

Selection process

After the initial search, the studies were screened for duplicates using the duplicate checking tool in the reference software Mendeley Desktop (v 1.19.4). After removal of duplicates, an abstract screening was conducted by the first author in order to remove studies that did not meet the eligibility criteria (e.g., studies outside the United States). Lastly, a detailed screening using the full text was conducted by the authors to determine which area of hardening (physical, procedural, or psychological) that the study addressed. Studies that addressed multiple areas of hardening were included in each area of hardening for the systematic review. During the full text screening process, additional studies were dropped only if study authors came to a consensus.

Findings

Study selection

The initial search using the search terms with the eligibility restrictions applied yielded 1,102 studies (see Figure 2). Eighty-three of these studies were duplicates across the three databases and were removed, resulting in 1,019 unique studies. Screening of study abstracts was conducted to further determine studies that did not meet the eligibility criteria. After screening of abstracts, 937 studies were removed. The primary reasons for removal during abstract screening were studies with no school hardening variables and studies that used qualitative methodology. A more detailed screening of the full text was conducted for the remaining 82 studies and an additional 41 studies were removed.

Physical hardening studies

Upon full-text screening, 28 studies were identified with at least one physical hardening variable among the study variables (see Table 1). Eighteen of the studies (64.3%) were conducted using national datasets while the remainder used data from states or a specific region within a state. When the unit of analysis were students, the samples were always students in middle and/or high schools. None of the studies regarding physical hardening, where the unit of analysis were students, used samples of elementary students. Ten of the studies (35.7%) used various physical hardening measures to create a composite variable (e.g., physical security measures¹⁹) or used these measures as indicators of a latent construct (e.g., school safety actions¹⁶), although the latent nature of such a construct is questionable.²⁰ Among the various physical hardening strategies that were either included as a variable or were part of a composite variable, resource officers had the highest frequency—20 out of the 28 studies (71.4%) included resource officers (see Figure 3).

Figure 2.
Flowchart of the Study Selection Process for the Systematic Review

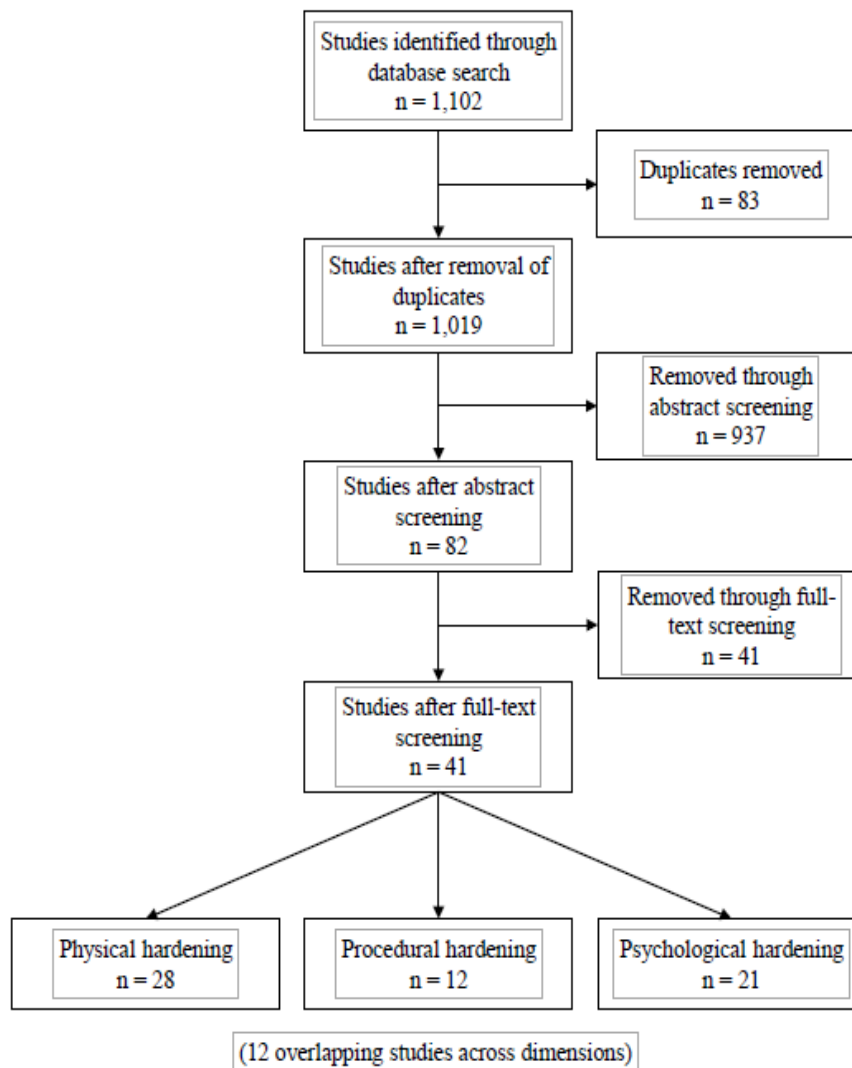


Table 1.
Summary of Selected Studies Regarding Physical Hardening

Author(s) (Year)	Sample size (age range ^a /UA ^b)	Region	Variables ^c	
			Physical hardening	School safety
Bhatt & Davis (2018)	n = 34,691 (15-18)	Florida	Metal detectors	Bringing weapons to school / Being threatened by weapon Skipped school because felt unsafe Offered illegal drugs at school Physical fights at school

Blosnich & Bossarte (2011)	<i>n</i> = 5,722 (12-18)	National	Resource officers Hallway supervision Security cameras Student ID badges	Peer victimization (e.g., name calling, rumors, threatened with harm)
Brady, Balmer, & Phenix (2007)	<i>n</i> = 20 (schools, H ^d)	New York City	Resource officers Police presence	Major crimes Noncriminal police incidents
Cecen-Celik & Keith (2019)	<i>n</i> = 4,415 (12-18)	National	Physical security measures (resource officers, metal detectors, locked doors, security cameras, hallway supervision, student ID badges)	Direct bullying Indirect bullying
Chen (2008)	<i>n</i> = 712 (schools, H)	National	Security measures (controlled access, student monitoring activities [details not provided])	Criminal incidents in school
Cheurprakobkit & Bartsch (2005)	<i>n</i> = 215 (schools, M, H)	Texas	Resource officers Metal detectors Locked doors Security cameras	Drug crime Interpersonal crime
Connell (2018)	<i>n</i> = 3,073 (14-19)	Mid-Atlantic	Awareness of security measures (hallway supervision, locked doors, security cameras)	Perception of school safety
Crawford & Burns (2015)	<i>n</i> = 1,659 (schools, E, M, H)	National	Resource officers Locked doors Security cameras Metal detectors	Serious violence (rape, robbery, aggravated assault) Threats/attacks with weapon Gun possession
Crawford & Burns (2016)	<i>n</i> = 1,659 (schools, E, M, H)	National	Resource officers Locked doors Security cameras	Serious violence (rape, robbery, aggravated assault) Physical fights Gun/knife possession Threats/attacks with weapon
Cuellar (2018)	<i>n</i> = 936 (schools, H)	National	Physical safety strategies (metal detectors, locked doors, security cameras)	Violence (e.g., rape, robbery, physical attacks/threats with weapon) Physical fights Gun/explosive possession
Cuellar, Elswick, & Theriot (2018)	<i>n</i> = 229 (school social workers)	National	Metal detectors Alert systems Locked doors	Perceived effectiveness of safety measure

			Security cameras Resource officers Fencing around school	
Devlin & Gottfredson (2018)	<i>n</i> = 480 (schools, E, M, H)	National	Roles of resource officers	Crimes recorded Crimes reported to law enforcement
Devlin, Santos, & Gottfredson (2018)	<i>n</i> = 480 (schools, E, M, H)	National	Resource officers	Bullying
Dohy & Banks (2018)	<i>n</i> = 148 (schools, E, M, H)	Ohio	Resource officers	Insubordination Physical violence
Fisher, Mowen, & Boman (2018)	<i>n</i> = 7,695 (17-18)	National	School's proclivity toward security (locked doors, metal detectors, security cameras, resource officers, alarm system)	Threatened with harm Physical altercation Something stolen
Gastic (2011)	<i>n</i> = 7,618 (12-18)	National	Metal detectors	Perception of school safety
Gerlinger & Wo (2016)	<i>n</i> = 23,800 (12-18)	National	Security measures index (resource officers, metal detectors, locked doors)	Physical bullying Verbal bullying Relational bullying
Heinen et al. (2007)	<i>n</i> = 267 (teachers & staff)	West Virginia	Security cameras (in collaboration with law enforcement)	Perception of school safety
Johnson (1999)	<i>n</i> = 17 (teachers & staff)	Southern city	Resource officers	Gang activities Misdemeanor arrests Disciplinary acts
Kitsantas, Ware, & Martinez-Arias (2004)	<i>n</i> = 3,092 (11-14)	National	School safety actions (resource officers, hallway supervision)	Perception of school safety
Lindstrom Johnson et al. (2017)	<i>n</i> = 58 (schools, H)	Maryland	Hallway supervision	Violence (weapon carrying, fighting, bullying)
May, Fessel, & Means (2004)	<i>n</i> = 128 (principals)	Kentucky	Resource officers	Resource officer effectiveness Perceived change in safety issues (e.g., fighting, drugs, theft)
Mayer & Leone (1999)	<i>n</i> = 6,947 (12-19)	National	Secure building (metal detectors, resource officers, locked doors, hallway supervision)	School disorder (presence of gangs, drugs, attacks, and theft)

Pentek & Eisenberg (2018)	<i>n</i> = 126,868 (13-17)	Minnesota	Awareness of resource officer presence	Perception of school safety
Perumean-Chaney & Sutton (2013)	<i>n</i> = 13,386 (12-18)	National	Resource officers Metal detectors Security cameras Locked doors	Perception of school safety
Schreck et al. (2003)	<i>n</i> = 6,418 (11-18)	National	Resource officers Metal detectors Locked doors Hallway supervision	Victimization (theft, take property by force, physical attack)
Sevigny & Zhang (2018)	<i>n</i> = 936 (schools, H)	National	Strengthen formal surveillance (resource officers, security cameras) Target harden (metal detectors)	Violent crime (rape, robbery, physical attacks)
Theriot & Orme (2016)	<i>n</i> = 1,956 (11-18)	National	Interactions with and attitudes toward resource officers	Perception of school safety

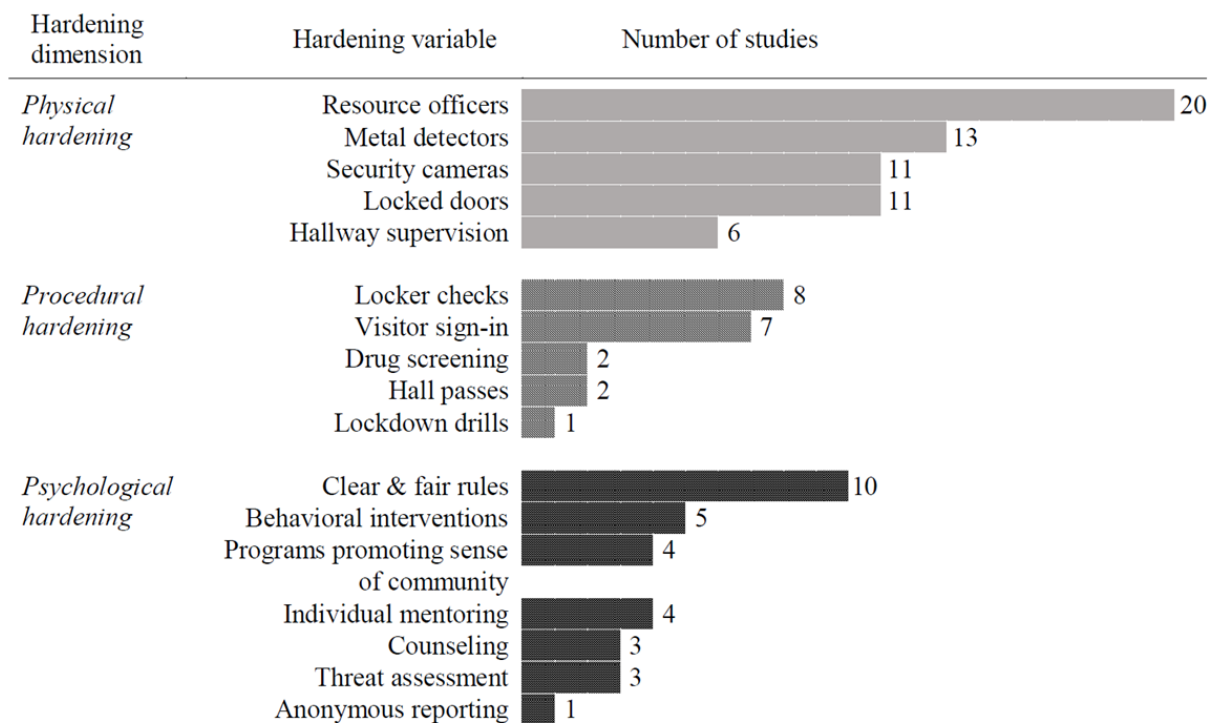
^a Age range provided only when sample was students

^b UA = unit of analysis (if not students)

^c Variables in parentheses indicate that they were used for a composite variable or latent construct)

^d H = high schools; M = middle schools; E = elementary schools

Figure 3.
Frequency of Hardening Variables across Selected Studies



Procedural hardening studies

The full-text screening identified 12 studies that included a procedural hardening variable (see Table 2). With the exception of two studies, most of the studies (83.3%) were conducted using national datasets. Procedural hardening variables were included as one of the components of various composite variables in 66.6% of the studies. In five studies, the procedural hardening variable was part of a composite variable that also included physical hardening variables.^{16,19,21-23} For example, Cecen-Celik and Keith¹⁹ included visitor sign-in and locker checks in their composite variable 'physical security measures,' which also included physical hardening measures such as resource officers, metal detectors, and security cameras. Locker checks (9 of 12 studies; 75%) and visitor sign-ins (7 of 12 studies; 58.3%) were the two most frequently included procedural hardening variables among the identified studies (see Figure 3).

Table 2.***Summary of Selected Studies Regarding Procedural Hardening***

Author(s) (Year)	Sample size (age range ^a /UA ^b)	Region	Variables ^c	
			Procedural hardening	School safety
Cecen-Celik & Keith (2019)	<i>n</i> = 4,415 (12-18)	National	Physical security measures (visitor sign-in, locker checks)	Direct bullying Indirect bullying
Cheurprakobkit & Bartsch (2005)	<i>n</i> = 215 (schools, M ^d , H)	Texas	Locker checks	Drug crime Interpersonal crime
Cuellar (2018)	<i>n</i> = 936 (schools, H)	National	Legal strategies (locker checks, drug screening) Preparedness safety strategies (written plans for shootings, hostage situation, bomb threats, and suicide)	Violence (e.g., rape, robbery, physical attacks/threats with weapon) Physical fights Gun/explosive possession
Cuellar, Elswick, & Theriot (2018)	<i>n</i> = 229 (school social workers)	National	Locker checks Visitor sign-in Drug screening	Perceived effectiveness of safety measure
Fisher, Mowen, & Boman (2018)	<i>n</i> = 7,695 (17-18)	National	School's proclivity toward security (locker checks)	Threatened with harm Physical altercation Something stolen
Gerlinger & Wo (2016)	<i>n</i> = 23,800 (12-18)	National	Security measures index (locker checks)	Physical bullying Verbal bullying Relational bullying
Kitsantas, Ware, & Martinez-Arias (2004)	<i>n</i> = 3,092 (11-14)	National	School safety actions (locker checks, visitor sign-in, hall passes)	Perception of school safety
Mayer & Leone (1999)	<i>n</i> = 6,947 (12-19)	National	Secure building (locker checks, visitor sign-in)	School disorder (presence of gangs, drugs, attacks, and theft)

Perumean-Chaney & Sutton (2013)	<i>n</i> = 13,386 (12-18)	National	Non-physical security policies (visitor sign-in, hall passes)	Perception of school safety
Schreck et al. (2003)	<i>n</i> = 6,418 (11-18)	National	Visitor sign-in	Victimization (theft, take property by force, physical attack)
Sevigny & Zhang (2018)	<i>n</i> = 936 (schools, H)	National	Control access (visitor sign-in) and contraband (locker checks)	Violent crime (rape, robbery, physical attacks)
Zhe & Nickerson (2007)	<i>n</i> = 74 (8-11)	New York	Lockdown drill	Knowledge of safety procedures Perception of school safety

^a Age range provided only when sample was students

^b UA = unit of analysis (if not students)

^c Variables in parentheses indicate that they were used for a composite variable or latent construct)

^d H = high schools; M = middle schools; E = elementary schools

Psychological hardening studies

Twenty-one studies that included psychological hardening variables were identified through full-text screening (see Table 3). The majority of these identified studies (52.4%) were conducted using data from specific regions in the United States rather than national datasets. In 11 of the studies (52.4%), the psychological hardening variable was part of a larger composite variable. Among studies where the unit of analysis was students, none involved elementary students. When the unit of analysis was schools, only two studies included elementary schools. The most frequently included psychological hardening variable was clear and fair school rules (10 of 21 studies; 47.6%; see Figure 3).

Table 3.
Summary of Selected Studies Regarding Psychological Hardening

Author(s) (Year)	Sample size (age range ^a /UA ^b)	Region	Variables ^c	
			Psychological hardening	School safety
Akiba (2010)	<i>n</i> = 2,787 (15)	National	Clear and fair school rules	Fear of school violence
Barnes et al. (2017)	<i>n</i> = 5,284 (schools: E, M, H ^d)	National	Behavior modification interventions Counseling Individual mentoring Programs promoting sense of community	Bullying Verbal abuse Violent incidents Police-reported incidents
Cecen-Celik & Keith (2019)	<i>n</i> = 4,415 (12-18)	National	Interactionist security measures (school rules are fair and enforced)	Direct bullying Indirect bullying
Cheurprakobkit & Bartsch (2005)	<i>n</i> = 215 (schools: M, H)	Texas	Character education programs Individual mentoring	Drug crime Interpersonal crime

Cornell et al. (2011)	<i>n</i> = 49 (schools: H)	Virginia	Threat assessment	Assaults Threats Bullying
Cornell et al. (2009)	<i>n</i> = 280 (schools: H)	Virginia	Threat assessment	Victimization (e.g., theft, physical attacks) Bullying victimization (physical, verbal, social) Bullying climate
Cuellar (2018)	<i>n</i> = 936 (schools, H)	National	Interactionist safety strategies (behavior modification, counseling, individual mentoring, programs promoting sense of community)	Violence (e.g., rape, robbery, physical attacks/threats with weapon) Physical fights Gun/explosive possession
Cuellar et al. (2018)	<i>n</i> = 229 (school social workers)	National	Individual mentoring Programs promoting sense of community Anonymous reporting	Perceived effectiveness of safety measure
Gerlinger & Wo (2016)	<i>n</i> = 23,800 (12-18)	National	Authoritative school discipline (school rules are fair and enforced)	Physical bullying Verbal bullying Relational bullying
Gregory et al. (2010)	<i>n</i> = 7,318 (14-15)	Virginia	School structure (school rules are fair and enforced)	Victimization (e.g., theft, physical attacks) Bullying victimization
Hurd et al. (2018)	<i>n</i> = 28,104 (12-21)	Maryland	Lack of school order (e.g., students disobey rules, rules not enforced)	Externalizing behaviors (physical fighting, weapon carrying)
Kitsantas et al. (2004)	<i>n</i> = 3,092 (11-14)	National	School climate (teachers maintain good classroom discipline, principal and assistant principal maintain good discipline)	Perception of school safety
Lapan et al. (2001)	<i>n</i> = 22,601 (12-13)	Missouri	Counseling and guidance program	Perception of school safety
Lindstrom Johnson et al. (2017)	<i>n</i> = 28,592 (14-18)	Maryland	Rules and consequences (clear rules)	Violence (weapon carrying, fighting, bullying)
Mayer & Leone (1999)	<i>n</i> = 6,947 (12-19)	National	System of law (knowledge of school rules and consequences, fair and consistent enforcement)	School disorder (presence of gangs, drugs, attacks, and theft)
Meyer-Adams & Conner (2008)	<i>n</i> = 7,583 (11-14)	Philadelphia, PA	Psychosocial environment (fair rules, consistent enforcement of rules)	Weapon carrying for protection

Nekvasil & Cornell (2015)	n = 332 (schools: M)	Virginia	Threat assessment	Bullying victimization General victimization (verbal and physical aggression from other students) Prevalence of teasing and bullying Teachers' perception of safety
Sevigny & Zhang (2018)	n = 936 (schools: H)	National	Reduce stress (programs promoting sense of community) Assist compliance (recognizing early warning signs of students likely to exhibit violence/use substances, positive behavioral interventions and supports)	Violent crime (rape, robbery, physical attacks)
Sprague et al. (2001)	n = 15 (schools: E, M)	Pacific Northwest	Behavioral intervention	Perception of school safety
Williams et al. (2018)	n = 585 (14-18)	Southern States	Rules and norms (clear and fair rules)	Perception of school safety
Wynne & Joo (2011)	n = 5,592 (12-18)	National	Strict enforcement of rules	Criminal victimization (property or violence) Noncriminal victimization (bullying, fighting, hate-related abuse)

^a Age range provided only when sample was students

^b UA = unit of analysis (if not students)

^c Variables in parentheses indicate that they were used for a composite variable or latent construct)

^d H = high schools; M = middle schools; E = elementary schools

Synthesis of findings

By far, physical hardening was the most studied dimension of the three—28 of the 41 studies included a physical hardening variable. Among the 41 studies identified through full-text screening, eight studies included aspects of all three dimensions of hardening.^{16,19,22-27} While the majority of studies investigating physical hardening or psychological hardening variables solely focused on each dimension, only one study that included procedural hardening variables was solely focused on procedural hardening.²⁷ Zhe and Nickerson²⁸ was the only study (i.e., investigating impact of lockdown drills on knowledge of safety procedures and perceptions of school safety) that included elementary students in their sample, whereas all other studies where the unit of analysis was students used middle and/or high schoolers for their sample. Psychological hardening studies were less likely to be conducted with national datasets (47.6%) compared to physical hardening studies (64.3%) and procedural hardening studies (83.3%).

IMPLICATIONS FOR SCHOOL SAFETY PRACTICES

Research Implications

The proposed 3D school hardening framework posits that all three dimensions are equally important in increasing school safety and that resources need to be equally invested in all three dimensions to achieve this goal. Along the same line, balance in research on the three dimensions would be ideal. However, the findings from the current systematic review show that the majority of studies are conducted on physical hardening strategies. This is consistent with federal and state efforts within the United States to focus funding on physical hardening initiatives. Yet, it is important to note that the disproportional focus on physical hardening found in the literature is inconsistent with and contrary to the comprehensive approach to school violence prevention advocated by interdisciplinary professional groups.⁹

In particular, there were relatively less studies focused solely on procedural hardening compared to physical hardening and psychological hardening. Studies with procedural hardening variables were typically conducted as part of a broader investigation of variables related to physical hardening. Among the various procedural hardening strategies, few studies have examined the impact of lockdown drills on school safety (see Figure 3). Currently, 95% of schools in the United States report conducting lockdown drills and the number of schools with plans in place for shooting events have increased from 79% in 2003-04 to 92% in 2015-16.¹² Given the prevalence of lockdown drills in the United States, more research regarding the effectiveness and/or unintended impact of particular procedural hardening strategies is especially warranted. Specifically, we suggest that future studies differentiate between lockdown drills and active shooter drills. In addition to investigating the impact of these methods on reducing school violence, we recommend further research on the effects of drill type on students' psychological well-being (e.g., negative, such as anxiety/traumatic reaction; positive, such as perceptions of safety/improved behavioral health).

Empirical testing of the proposed 3D school hardening framework would also be a valuable contribution to the school safety literature. Future studies can compare schools that have a balance of all three hardening dimensions in their school safety strategies with schools that lack balance (e.g., a school that has disproportionately invested in physical hardening measures) and investigate whether there are differences in school safety related variables across these schools. Further, studies investigating the effects of each physical, procedural, and psychological hardening variable could provide valuable information for schools considering which strategies to employ, in order to maximize school safety efforts within their context.

Policy Implications

As mentioned previously, most of the monetary funding being used to increase school safety in the United States has been limited to physical hardening strategies. In order for schools to successfully implement a balanced three-dimensional approach to school target hardening, funding needs to be made available to implement more procedural and psychological hardening strategies in the name of promoting a safe and supportive school environment. For example, schools should be able to request funding for implementing counseling programs and mental health screening tools as a means of increasing school safety. Additionally, given that the effectiveness of various school violence prevention strategies have been largely inconclusive²⁹, funding agencies should require, as a part of the request for proposals, that schools state how they will empirically evaluate the effectiveness of the school safety approach that will be

funded. Collaboration between schools and local research institutions may be one way to efficiently explore the cost-effectiveness of a diverse array of violence prevention strategies.

CONCLUSION

The present study proposed a three-dimensional hardening framework that illustrates the importance of a comprehensive approach to increasing school safety. Overall, this systematic literature review found that physical hardening measures were more frequently studied compared to procedural and psychological hardening measures. These findings are consistent with the United States' prioritization of funding for physical hardening initiatives. Additional empirical studies should be conducted on all three hardening dimensions as they unfold within the uniqueness of the school districts that employ them. This data-based approach not only will help to provide additional insight into the potential effectiveness of the safety measures being implemented, but it may also help to create additional evidence for schools and funders to take a more balanced approach to school safety that encompasses all three hardening dimensions.

References

- [1] Docherty M, Sweeten G, Craig T, et al. Prevalence and risk factors associated with carrying a gun to school during adolescence: A statewide study of middle and high school students. *J Sch Violence*. 2020;19(1):35-47. doi:10.1080/15388220.2019.1703718
- [2] Finkelhor D, Vanderminden J, Turner H, Shattuck A, Hamby S. At-school victimization and violence exposure assessed in a national household survey of children and youth. *J Sch Violence*. 2016;15(1):67-90. doi:10.1080/15388220.2014.952816
- [3] McMahon SD, Martinez A, Espelage D, et al. Violence directed against teachers: Results from a national survey. *Psychol Sch*. 2014;51(7):753-766. doi:http://dx.doi.org/10.1002/pits.21777
- [4] Melgar L. Are school shootings becoming more frequent? Published 2019. <https://gunsandamerica.org/story/19/05/17/are-school-shootings-becoming-more-frequent-we-ran-the-numbers/>
- [5] Page A. Center for Homeland Defense and Security releases comprehensive database of school shootings in America. Published 2018. <https://www.hsdl.org/c/database-of-school-shootings-in-america>
- [6] Kolbe LJ. School Gun Violence in the United States. *J Sch Health*. 2020;90(3):245-253. doi:https://doi.org/10.1111/josh.12866
- [7] Federal Commission on School Safety. *Final Report of the Commission on School Safety*. Published 2018. <https://www2.ed.gov/documents/school-safety/school-safety-report.pdf>
- [8] Carlson JS. Keeping students safe is a growth industry struggling to fulfill its mission. The Conversation. Published 2019. <https://theconversation.com/keeping-students-safe-is-a-growth-industry-struggling-to-fulfill-its-mission-122705>
- [9] Cowan KC, Vaillancourt K, Rossen E, Pollitt K. *A Framework for Safe and Successful Schools*. National Association of School Psychologists; 2013.
- [10] United States Secret Service. *Enhancing School Safety Using a Threat Assessment Model: An Operational Guide for Preventing Targeted School Violence*. United States Department of Homeland Security; 2018. https://www.secretservice.gov/sites/default/files/reports/2020-10/USSS_NTAC_Enhancing_School_Safety_Guide.pdf
- [11] Cohen LE, Felson M. Social change and crime rate trends: A routine activities approach. *Am Sociol Rev*. 1979;44(4):588-608. doi:10.2307/2094589
- [12] Musu L, Zhang A, Wang K, Zhang J, Oudekerk BA. *Indicators of School Crime and Safety*. National Center for Education Statistics, United States Department of Education; 2019. <https://nces.ed.gov/pubs2019/2019047.pdf>

- [13] Clark RD, Lab SP. Community characteristics and in-school criminal victimization. *J Crim Justice*. 2000;28(1):33-42. doi:[http://dx.doi.org/10.1016/S0047-2352\(99\)00030-6](http://dx.doi.org/10.1016/S0047-2352(99)00030-6)
- [14] Dohy J, Banks T. The impact of school policing on student behaviors in Ohio public schools. *J Sch Violence*. 2018;17(3):311-323. doi:<http://dx.doi.org/10.1080/15388220.2017.1322519>
- [15] Horton A. The prevention of school violence: New evidence to consider. *J Hum Behav Soc Environ*. 2001;4(1):49-59. doi:http://dx.doi.org/10.1300/J137v04n01_04
- [16] Kitsantas A, Ware HW, Martinez-Arias R. Students' perceptions of school safety: Effects by community, school environment, and substance use variables. *J Early Adolesc*. 2004;24(4):412-430. doi:<http://dx.doi.org/10.1177/0272431604268712>
- [17] Perumean-Chaney SE, Sutton LM. Students and perceived school safety: The impact of school security measures. *Am J Crim Justice*. 2013;38(4):570-588. doi:<http://dx.doi.org/10.1007/s12103-012-9182-2>
- [18] Liberati A, Altman DG, Tetzlaff J, et al. The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: Explanation and elaboration. *Ann Intern Med*. 2009;151(4):W65-94. internal-pdf://128.111.178.117/Liberati et al. (2009). The PRISMA statement f.pdf
- [19] Cecen-Celik H, Keith S. Analyzing predictors of bullying victimization with routine activity and social bond perspectives. *J Interpers Violence*. 2019;34(18):3807-3832. doi:<http://dx.doi.org/10.1177/0886260516672941>
- [20] Mueller RO, Hancock GR. Structural equation modeling. In: Hancock GR, Mueller RO, eds. *The Reviewer's Guide to Quantitative Methods in Social Sciences*. Routledge; 2010:371-384.
- [21] Fisher BW, Mowen TJ, Boman IV JH. School security measures and longitudinal trends in adolescents' experiences of victimization. *J Youth Adolesc*. 2018;47(6):1221-1237. doi:<http://dx.doi.org/10.1007/s10964-018-0818-5>
- [22] Gerlinger J, Wo JC. Preventing school bullying: Should schools prioritize an authoritative school discipline approach over security measures? *J Sch Violence*. 2016;15(2):133-157. doi:<http://dx.doi.org/10.1080/15388220.2014.956321>
- [23] Mayer MJ, Leone PE. A structural analysis of school violence and disruption: Implications for creating safer schools. *Educ Treat Child*. 1999;22(3):333-356. <http://ezproxy.msu.edu/login?url=https://search.proquest.com/docview/619440096?accountid=12598>
- [24] Cheurprakobkit S, Bartsch RA. Security measures on school crime in Texas middle and high schools. *Educ Res*. 2005;47(2):235-250. doi:<http://dx.doi.org/10.1080/00131880500104366>
- [25] Cuellar MJ. School safety strategies and their effects on the occurrence of school-based violence in U.S. high schools: An exploratory study. *J Sch Violence*. 2018;17(1):28-45. doi:<http://dx.doi.org/10.1080/15388220.2016.1193742>
- [26] Cuellar MJ, Elswick SE, Theriot MT. School social workers' perceptions of school safety and security in today's schools: A survey of practitioners across the United States. *J Sch Violence*. 2018;17(3):271-283. doi:<http://dx.doi.org/10.1080/15388220.2017.1315308>
- [27] Sevigny EL, Zhang G. Do barriers to crime prevention moderate the effects of situational crime prevention policies on violent crime in high schools? *J Sch Violence*. 2018;17(2):164-179. doi:<http://dx.doi.org/10.1080/15388220.2016.1275657>
- [28] Zhe EJ, Nickerson AB. Effects of an intruder crisis drill on children's knowledge, anxiety, and perceptions of school safety. *School Psych Rev*. 2007;36(3):501-508. <http://ezproxy.msu.edu/login?url=https://search.proquest.com/docview/621905071?accountid=12598>
- [29] Price JH, Khubchandani J. School firearm violence prevention practices and policies: Functional or folly? *Violence Gend*. 2019;6(3):154-167. doi:<http://dx.doi.org/10.1089/vio.2018.0044>

Corresponding Author: John S. Carlson, PhD, College of Education, Michigan State University (carlsoj@msu.edu)