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Research Report

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A Systems Approach to Physical Security in K–12 Schools

A core mission of kindergarten-through–12th grade (K–12) schools across the United States is to provide a safe environment in which school-age children can thrive and where teaching and learning can proceed free of crime and violence. As schools strive to fulfill their educational mission, one of the challenges they face is minimizing the risk of criminal and violent acts that occur within and outside school boundaries. These incidents affect not just

KEY FINDINGS

- **A systems approach requires conceptualizing school physical security as a component of the broader school safety system.** Such an approach also includes the elements of prevention and response and recovery. Protection and risk mitigation extend beyond the physical security space to affect and interact with important elements of school violence prevention, such as student mental health and school climate, as well as emergency response and recovery efforts.
- **School physical security is a system consisting of physical security equipment and technology, building and architectural design features, people and personnel, policies and procedures, and associated training and exercise requirements.** The equipment, technology, and design features that a school has in place to protect its campus are all interrelated within the physical security space and have cost and other implications that local education agencies (LEAs) will need to consider. The people and personnel that schools have to provide security, as well as related policies, procedures, and training, ensure that these interconnected technologies, equipment, and site and building design features work in concert and in the service of the larger system.
- **LEAs will be best placed to achieve security and safety benefits when they take a layered approach to protection and mitigation.** Measures in place at the campus perimeter, school grounds, building perimeter, and building interior provide incremental protection against threats and help prevent single points of failure. How schools prioritize certain layers over others will depend on their unique contexts, including the surrounding neighborhood, campus and building layout, student population, and geographical location.

the people involved but also bystanders and the community within and surrounding the school. According to the National Center for Education Statistics (NCES), students ages 12 to 18 experienced more than 800,000 nonfatal victimizations at school in 2018, and schools across the country reported a total of 66 school shootings during the 2018–2019 school year, 29 of which included deaths (Wang et al., 2020).[1] Although the latter type of violence receives the most media attention because of its severity, more-common problems can also have significant and enduring effects on children's school and life outcomes; schools regularly address challenges related to trespassing, sexual assault, physical fighting, weapon carrying, bullying, and widespread classroom disorder, as well as the distribution, possession, and use of alcohol and drugs (Schwartz et al., 2016).

Schools have responded in a variety of ways to prevent crime and violence on their campuses—by, for instance, implementing behavioral interventions and zero-tolerance policies,[2] mandating school uniforms, and creating anonymous tip lines for students to report threatening behavior or acts of violence. In the physical security realm, schools have also turned to limiting or controlling access to their campuses—through, for example, improved visitor management systems, increased video surveillance, door lock systems, and security guards. According to NCES, schools increased their use of security cameras by 19 percent in 2018 from levels in the 1999–2000 school year and their use of security staff by 20 percent; as of July 2020, the overwhelming majority of schools (92 percent) reported having written plans in place for procedures that should take place in the event of an active-shooter situation (Wang et al., 2020).

There has been growing attention to school safety and the related growth in the school safety technology sector and to the development of guidance at many levels and from a variety of sources. However, available tools and resources do not yet provide local education agencies (LEAs)[3] with everything that they need to support their decisions about how to best approach physical security to protect their campuses (Steiner et al., 2021). Guidance from the federal, state, and other levels in particular has been discrete and disjointed, often focusing on one topic, technology, or procedure at the expense of offering a holistic picture of how to protect and mitigate a full set of risks.[4] Just as the risks that schools face are diverse and manifold, so have been the physical security measures schools have implemented to respond to these risks. This diversity in both risk and possible responses underscores the complexity inherent in implementing a school safety plan that appropriately protects students, staff, and the school but does not impede efforts to create a welcoming and inclusive environment that promotes teaching and learning. Indeed, this is arguably one of the biggest challenges that schools currently face. To add to the challenge, LEA officials who are regularly tasked with making difficult decisions about how best to protect their environments are most often not experts in physical security.

Although no school will ever be immune to the risk of violence, schools can take effective approaches to safety by carefully considering and integrating security equipment, technologies, and design features

Abbreviations

APL	Johns Hopkins University Applied Physics Laboratory
CCTV	closed-circuit television
CISA	Cybersecurity and Infrastructure Security Agency
CPTED	Crime Prevention Through Environmental Design
DHS	U.S. Department of Homeland Security
EMS	emergency medical services
FEMA	Federal Emergency Management Agency
FFRDC	federally funded research and development center
HSOAC	Homeland Security Operational Analysis Center
ID	identification
ITTF	Illinois Terrorism Task Force
K–12	kindergarten through 12th grade
LEA	local education agency
NCES	National Center for Education Statistics
REMS	Readiness and Emergency Management for Schools
SRO	school resource officer
TA	technical assistance

with carefully designed personnel roles, policies and procedures, and training programs. Such an integrated approach can help stakeholders create safe and secure spaces for school communities and do not require that school principals, facility managers, or other teachers and staff become experts in physical security design and implementation.

Purpose and Approach

The purpose of this report is to synthesize the scholarly and broader literature on physical security planning from a wide variety of disciplines (including school-specific literature) to develop and present a systems approach to school physical security. The report itself is part of a larger effort to provide enhanced tools for K–12 schools and school systems to improve school safety, through the development of a revised edition of *K–12 School Security: A Guide for Preventing and Protecting Against Gun Violence* (U.S. Department of Homeland Security [DHS], 2018) and the associated survey. The comprehensive doctrine and methodology will assist LEAs in conducting vulnerability assessments and planning and implementing layered physical security elements and associated policies, procedures, practices, personnel, and training programs across K–12 districts and campuses.

In support of this objective, we conducted a two-phased literature review. In the first phase, we reviewed current guidance for school security measures, including federal, state, local, and nongovernment guidance and assessment resources as they pertain to school safety. We also reviewed the literature on the use of technology and physical security measures to keep schools safe, which addresses the effectiveness of approaches to school physical security and the key challenges associated with various approaches to school security and safety. This component of our review also included literature about the impact that security and resilience measures can have on the broader educational mission and school climate.

In the second phase, we expanded our review to include literature from sectors that we considered comparable to the school environment. The goal in broadening our search was to take advantage of work done addressing similar security problems in other contexts; we selected nonschool sectors and settings on the basis of their similarity to certain features of the school setting, including the need to maintain a welcoming and open environment; use by and passage through of large numbers of diverse people in terms of age and physical ability; and the existence of diverse facilities as a result of size, location, and other factors. Our review considered literature on physical security and safety in houses of worship; health care facilities; nonmilitary federal facilities; crowded places, including shopping centers and event spaces; the transportation sector; military facilities; critical infrastructure; and correctional facilities. Just as schools face the challenge of making investments in safety and security measures that do not impede other important characteristics of their facilities, these other types of locations and facilities must do so as well; we sought to benefit from that foundation.

Our sources across both review phases included federal, state, and local district guidance, as well as peer-reviewed and other published literature and research, policy- or issue-specific briefs, written opinion pieces from key stakeholders in the research and practitioner communities, commission reports, and course modules or instruction manuals. A technical appendix at the end of this report provides more detail on our methods.

The audience for this report and our companion report includes a variety of stakeholders. As noted previously, the reports will be important insofar as they inform the development of the Cybersecurity and Infrastructure Security Agency's (CISA's) revised guidance on school safety and an improved school safety survey tool. Our intent is also to make these reports accessible to LEAs and individual schools: They are intended to help school and district leaders better plan for security and safety and more effectively respond to requests for proposals for security planning support. Finally, these reports should also be of value to legislative bodies, including grant-making institutions and elected legislators who enact laws to support school safety.

Physical Security in the K–12 Context

Generally speaking, *physical security* refers to the protection of people and spaces from physical actions

Protection keeps people and property safe from threats and emergencies; mitigation reduces the damage caused by adverse incidents when they occur. Together, they make up a physical security system to deter, detect, delay, and respond to incidents.

and events that could cause serious harm, damage, or loss; DHS's Science and Technology Directorate defines it as "the protection of an organization's assets from threats that could cause losses or damages [sic]" (Science and Technology Directorate, 2016). The term usually describes specific measures and equipment that are designed to deny unauthorized access to facilities and protect people and property from damage or harm. Measures and equipment might include visitor management systems, closed-circuit television (CCTV) surveillance, protective barriers, metal detectors, locks, intrusion detection sensors and alarms, and security guards. Physical security can have a variety of goals and is most often assessed by the ability of specific measures—equipment, technologies, design features, procedures, and personnel—to interact and effectively identify, slow, and stop specific threats (Garcia, 2008; U.S. Interagency Security Council, 2015).[5]

We frequently use the terms *protection* and *mitigation* to refer to physical security. For our purposes, *protection* refers to the objective of keeping people and property safe from threats and emergencies, while *mitigation* refers to the goal of reducing the damage or harm caused by adverse incidents when they occur. We use the terms *physical security system* and *protection and mitigation system* interchangeably throughout the report. The physical security, or protection and mitigation, system consists of a set of measures that together reduce the safety risk that threats pose to an environment.

Different physical security measures can reduce risk either by producing a set of outcomes that limit the chances of a damaging event occurring or by dampening the effects of an event's adverse consequences. In the literature, these outcomes typically include the functions of *deterrence*, *detection*, *delay*, and *response* (Williams, 2019). Although, in this report, we do not focus in detail on deterrence, it is worth noting that deterrence is often the result of carefully applied measures to detect, delay, and respond to safety-related incidents (Morral and Jackson, 2009). When these pieces function appropriately, an attacker is more likely to believe that their plan will be too difficult to execute or will fail altogether and abort it. In short, LEAs should aim to plan to the tangible, more–easily estimated security outcomes of detection, delay, and response; these will create additional benefits to the extent that they also work to deter action.

Understanding that deterrence is a necessary function of physical security in schools, our focus in this research focuses primarily on the last three outcomes:

- *Detection* refers to a measure's ability to communicate that a safety-related incident is occurring or about to occur. Examples of measures that contribute to the detection function can include CCTV, security guard patrols, and open-plan designs that allow for natural surveillance.
- As a physical security outcome, *delay* includes those measures that increase the level of effort and resources necessary for a dangerous incident to occur. These can include fencing, landscaping design, or various locking mechanisms at entrances.

- *Response* refers to those measures that contribute to overcoming a threat or limiting the damage caused by a threat—security guards, communication and notification equipment, or first aid kits, among others. In general, physical security measures that provide early detection capabilities and sufficiently delay a threat enable timely and appropriate response that can limit the consequences of an event.

LEAs need a framework for thinking about how to approach physical security on their campuses and achieve the aforementioned outcomes. We describe four different types of analysis that, together and in this order, help them do so:[6]

1. A *threat analysis* focuses on the types of safety-related incidents that can occur at a school and how likely they are to happen. Threats vary from school to school, such that certain threats might be very likely in one school but rare in another.

2a. A *risk analysis* asks how serious the consequences of specific safety-related incidents might be should they occur and combines consequence estimates with the likelihood estimates derived from the threat analysis. A safety-related incident that is highly likely to occur and is also likely to have severe consequences would constitute a high-risk event. Less serious safety-related incidents, even if relatively common occurrences, would fall into a lower risk category.

2b. A *vulnerability analysis* asks what mix of passive, active, and procedural physical security or protection and mitigation measures the school already has in place and how these already work together to reduce the risks that school faces. A school with existing robust safety and physical security measures might already address a majority of the risks it faces, leaving little residual risk to address.

3. *Security planning* assesses any residual risk and focuses on what to do about it. For example, what measures might a school practically add to its suite of existing security methods, and what impact would these additions have on improving safety?

The focus of the discussion in this report is largely on segments 2b and 3 of this framework, although considering how different security solutions combine and interact to protect a school first requires a vision of the nature of the threat and the risk that it poses.

In conducting both vulnerability analysis and security planning, an LEA can consider applying different physical security measures—whether intended to provide protection against an event or mitigate its harmful effects—at various levels, or *layers*, across a facility or space. Here, we use the term *physical security layers* in reference to how various elements of the system are arranged across space and how they reinforce each other to provide effective protection. For instance, a layered system might include overlapping security measures, such as a perimeter fence, parking lot lighting, CCTV, and alarm systems, that together make it incrementally more difficult for an intruder to enter a protected zone undetected (National Academies of Sciences, Engineering, and Medicine, 2009).

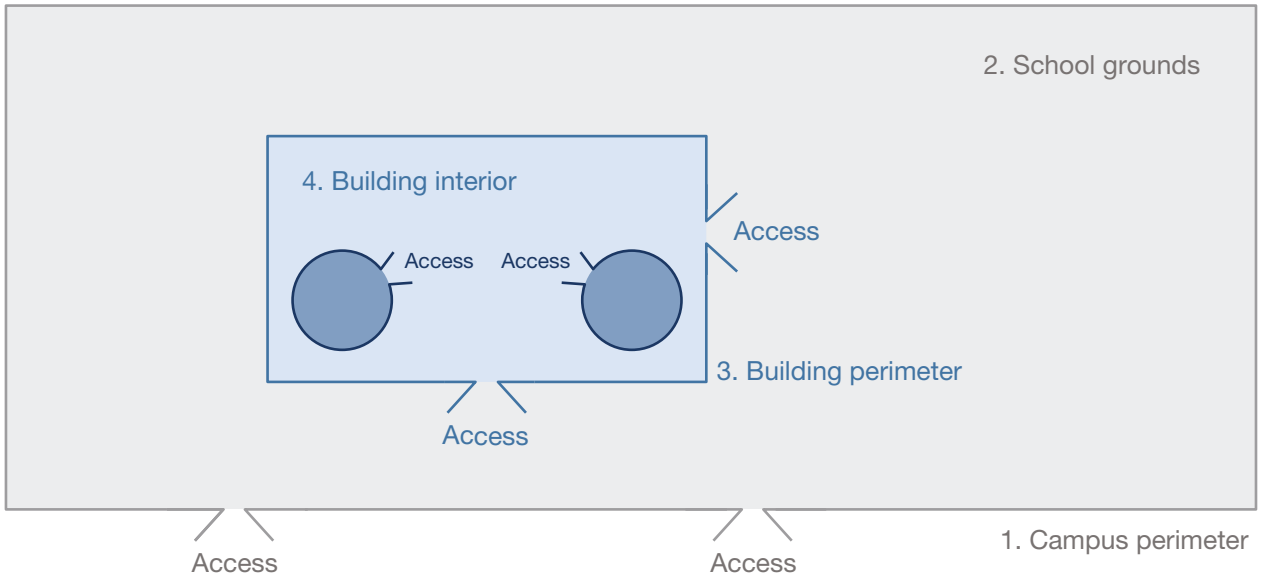
Figure 1 provides a schematic that lays out the various layers that LEA leaders need to consider when designing and implementing their physical security system. The four layers that we address in this report are

- the outer-perimeter layer, which demarcates the school property boundary
- the school-grounds layer, which encompasses everything within that perimeter, such as parking lots, playgrounds, and athletic fields
- the building-perimeter layer, which includes the building envelope and such areas as entrances, windows, and other places through which someone might gain access into the school building
- the building-interior layer itself, which includes everything from classrooms, hallways, and administrative offices to common spaces.[7]

Ultimately, a layered approach to physical security prevents single points of failure within the system; if an outside attacker successfully breaches a fence installed to protect a campus's outer boundaries (the campus perimeter layer), surveillance video from a CCTV system installed in the parking lot (the

FIGURE 1

A School's Physical Security Layers



school-grounds layer) will alert security personnel to their presence, enabling other response options. Failing that, key-card readers installed at building entrances (the building-perimeter layer) will make it more difficult for the attacker to enter the facility itself. Finally, additional CCTV systems installed in hallways and common areas (building-interior layer) can alert school personnel to an intruder if one has breached an entrance. Notably, schools will need to rely more or less on specific layers of protection depending on their layout, design, or surrounding neighborhood, among other factors. A school that is colocated with other businesses in a building or campus, for example, might not be able to limit access to protect its outer-perimeter layer. In this case, it might need to rely more on measures installed at other layers, such as the building perimeter or building interior. We discuss this layered approach to school physical security and its associated implications in more detail later in the report.

Taking a Systems Approach to Physical Security

This report takes a systems approach to school physical security. *Systems thinking*, or a *systems approach*, is a holistic approach to analysis that focuses on the way in which a system's constituent parts are related to one another and work together within that system (Meadows, 2008). *System* typically refers to a set of elements, measures, or procedures that work together as parts of a mechanism or interconnecting network to produce outcomes, achieve desired results, and avoid pernicious ones. The individual elements, or parts, of a system are necessary, but they are not self-sufficient; the system cannot achieve its purpose without the elements, but the elements by themselves cannot replicate the functions of the system. In other words, the whole (system) is greater than the sum of its parts (elements). Ultimately, systems approaches draw on interdisciplinary thinking and stand apart from traditional analytical approaches, which disaggregate systems into separate elements. They are widely applied across diverse research fields, including medicine, environmental studies, politics, economics, human resources, and education (Berry et al., 2018).

The incentives to maintain *stovepipe systems*—individual structures that operate independently of one another—are significant across organizations of nearly any kind. Indeed, such factors as limited budgets, protecting organizational turf, training staff so that they build up specialized and focused technical expertise, and the difficulty of

planning and implementing an integrated system all push toward the development of isolated structures and orders (Rabkin et al., 2004). Yet the dangers of isolated systems are clear. It is generally not effective to invest heavily in technology without training or equipping staff to leverage the security benefits that the technologies installed across facilities provide. Instead, a more reliable and effective approach to security becomes possible when all aspects of the system can work together to prevent, protect, and respond to events (Neudorff et al., 2006).

When we talk specifically about a *systems approach to school physical security* (or *protection and mitigation*), we stress the importance of ensuring that various security measures work together in an integrated fashion and that a plan takes into account the various contingencies that must also be in place for that system to work effectively. For example, technology installed to protect a school building will provide security benefits if school staff have a role in operating the technology and where policies and procedures are in place to respond to a threat when the technology detects one. Exercises and training further contribute to system effectiveness by providing opportunities for the school community to practice various responses as outlined in the policies and procedures. Moreover, a systems approach to protection and mitigation can help decisionmakers ensure that the implemented measures work in concert with the larger school safety system that also includes violence prevention and response and recovery phases. Ultimately, a school's approach to security should complement the school's broader education mission and not undermine school climate or the educational experience of students and staff.[8] School safety and security are part of the schools' larger mission; a systems approach to physical security prioritizes this relationship.

Organization of This Report

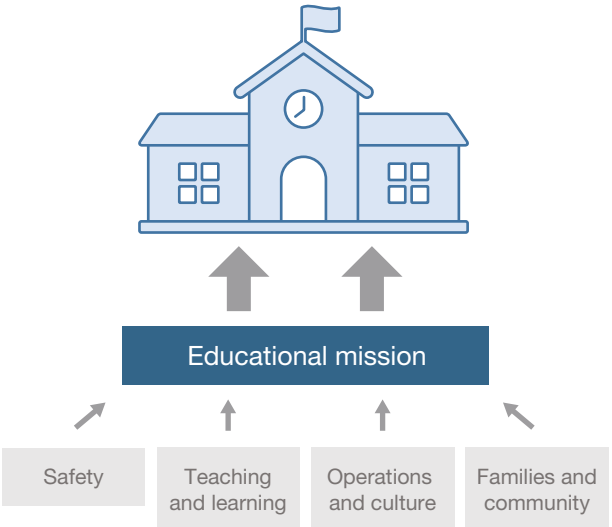
The remainder of this report consists of four additional sections:

- After providing an introduction to the full spectrum of school safety, or *school safety system*, the next section provides an overview of the three phases—prevention; protection and mitigation; and response and recovery—and their interconnections. It focuses in most depth on the protection and mitigation phase.
- The third section describes a systems approach to protection and mitigation in schools, focusing on identifying and assessing risks and associated physical security functions and needs.
- The fourth section breaks down the five elements of protection and mitigation and explains how a school can "build" its physical security system by integrating these elements and engaging external stakeholders.
- A final section summarizes our findings and lists implications for LEAs.

The School Safety System

Applying systems thinking to the school "enterprise," one might think of a school as a unit that incorporates various elements, including safety, teaching and learning, school operations and culture, and families and the surrounding community. School safety is just one element of this broader system or enterprise, and a school cannot achieve its educational mission

FIGURE 2
The School "Enterprise"



without all of these elements working in concert (see Figure 2).

Imagine a school surrounded by a ten-foot-high fence topped with barbed wire, where security cameras track students' and others' movements through the parking lot, and everyone has to walk through metal detectors as they pass through the front entrance. As students and teachers walk through the hallways, more security cameras hover overhead, and armed, uniformed guards conduct regular patrols. Once students are at their desks inside the classrooms, windowless doors and narrow, slit windows provide little natural sunlight. Even though the students seem to constantly be on edge, the school has not experienced a significant safety-related incident in more than a year; it is considered a "safe" school.

The U.S. Department of Education describes schools as "safe" on the basis of the absence of violence; a "safe" school is one that rarely experiences negative incidents, such as bullying, fights in the hallways, or active-shooter threats (National Center on Safe and Supportive Learning Environments, undated). Yet school safety and feeling safe in school are about much more than just the absence of violence; instead, we would argue, they might be more about the absence of fear. If this is true, then school safety and security are not just about putting in place protection measures and a set of associated procedures and policies but also about fostering environments free from fear, intimidation, violence, and isolation (Eith and Trump, 2019). On the surface, even though the measures described above might make a school seem *objectively* safe, they do not alone create an *environment of safety* suitable to achieve the educational goals of a school.

Schools that create and maintain a sense of inclusion and ensure that all feel welcome, in addition to feeling protected, are safe schools (Osher, Moroney, and Williamson, 2018). For example, school climate and student mental health are key elements to school safety insofar as they contribute to creating welcoming environments. Safe schools recognize the connections between the safety measures that they implement, the policies they have in place, the personnel they hire, and school climate. They are aware of the critical connections that exist between physical security—such elements as cameras, alarms, and security officers—and the social and emotional well-being of their students, staff, and broader population. As the Sandy Hook Advisory Commission stated in the opening pages of its final report,

> Schools should be great places to learn, not just because they are safe and the educational process is uninterrupted, but because the physical design of schools facilitates, excites and engenders interactions between . . . students, teachers, and staff, the spaces they are in and the world around them. (Sandy Hook Advisory Commission, 2015, p. 5)

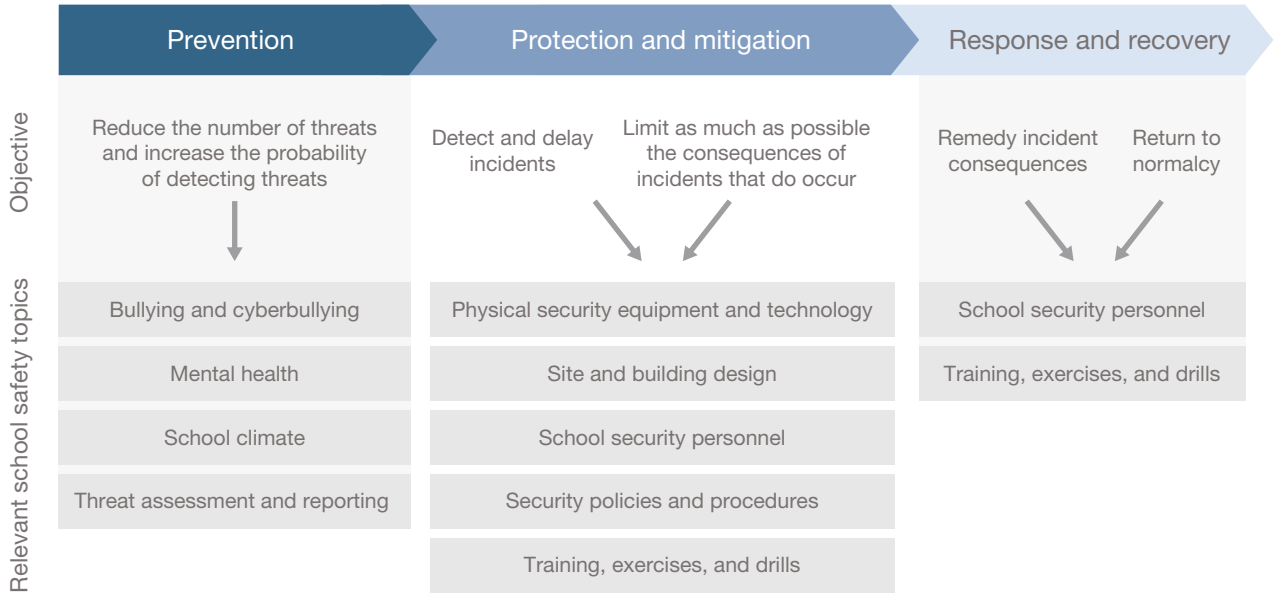
In 2018, the Federal Commission on School Safety was established to review safety efforts across U.S. schools and recommend best practices to keep them safe. The commission's final report recommended that the federal government create a clearinghouse to provide school safety strategies and serve as a central location for federal resources. The clearinghouse website, SchoolSafety.gov, provides resources and recommendations as they relate to preventing, protecting against, mitigating, responding to, and recovering from emergency situations (SchoolSafety.gov, undated). We used the clearinghouse as the starting point to describe what we conceptualize as the school safety system.

As Figure 3 shows, the school safety system is essentially a "system of systems": The physical security system falls under the scope of protection and mitigation, but the subcategories in each phase show that there are clear interconnections between the prevention, protection and mitigation, and response and recovery phases of school safety. The next section introduces each of these phases before discussing their linkages.

Prevention

According to SchoolSafety.gov, creating a safe school environment is as much about addressing underlying conditions that lead to problems as it is about designing a physical security system to protect a school's population. The goal of violence prevention in schools is to reduce the number of active threats and increase the probability of detecting them before they turn into active safety-related incidents. The key

FIGURE 3
The School Safety System



elements to preventing and detecting threats focus on improving student mental health, addressing issues related to bullying and cyberbullying, improving school climate, and maintaining a robust threat assessment and reporting process (SchoolSafety.gov, undated). Prioritizing these topics decreases the chances that problems will occur inside the school and thus improves the well-being of the school community more generally.

In this analysis, we distinguish between passive and active contributors to school safety. Some factors that contribute to enhancing school safety through prevention, such as a welcoming and inclusive school climate, work passively to reduce the number of threats a school faces insofar as they do not depend on detection to prevent them from occurring. Others, however, depend significantly on initiatives in place in the protection and mitigation space to prevent threats from becoming safety-related incidents. For instance, a robust threat assessment and reporting process and efforts to reduce bullying both depend on a functioning detection system and on response capabilities; school personnel need to detect threats and know how to respond to them to avoid escalation to full-blown safety-related incidents (National Threat Assessment Center, 2019).

In addition, the approach that a school takes to physical security (i.e., the measures it puts in place to protect and mitigate adverse events) can have important effects on components critical to the prevention phase. Certain measures, for example, might degrade student perceptions of safety and add an element of stress to the learning environment, thereby harming efforts to ensure the mental health of the student body (Warnick and Kapa, 2019; National Association of School Psychologists and National Association of School Resource Officers, 2017). Other measures might have significant adverse impacts on school climate and thus compound the risks that schools face (Ergenbright and Hubbard, 2012; Garver and Noguera, 2012). In some extreme cases, schools' narrow focus on protection and mitigation has caused them to ignore other services and school conditions that are essential to academic achievement, student well-being, and school safety more generally; as funding for physical security measures has increased in some districts, it has decreased for guidance counselors, social workers, and school psychologists (Fuentes, 2011; Kupchik, 2010).

As these studies suggest, the highly visible and intrusive measures in place to enhance security in this section's opening example—barbed-wire fencing, outdoor and indoor surveillance cameras, metal

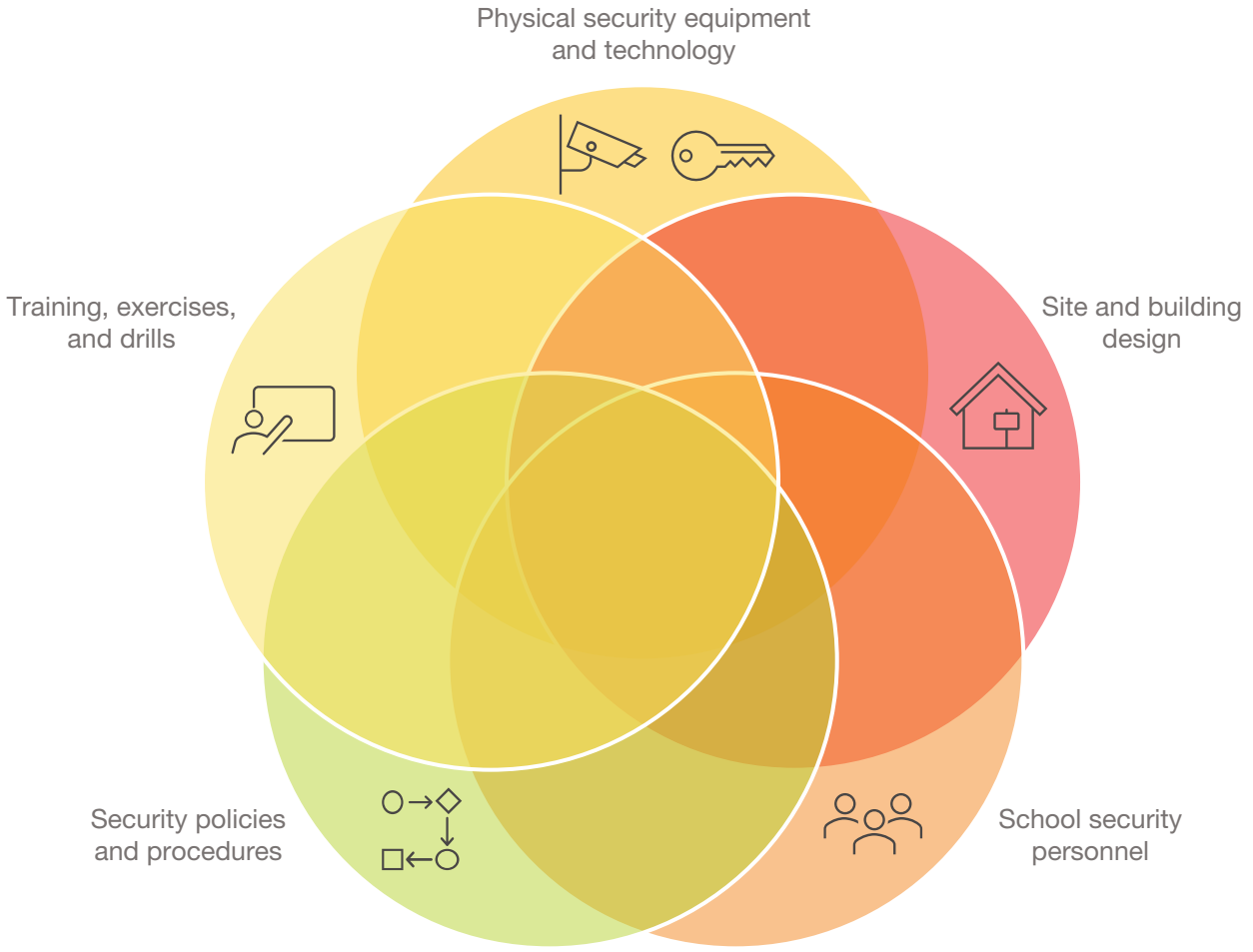
detectors, and narrow windows—might work to elevate, rather than quell, students' fear of victimization and degrade school climate (see, e.g., Bachman, Randolph, and Brown, 2011). Narrowing the measure of a school's success to any one area—in this case, security—will result in a fragmented approach to improvement and lead LEAs to ignore other critically relevant elements tied to prevention. This is not to say that schools should not prioritize safety and security but that they should take a holistic approach to safety.

Protection and Mitigation

As we define it, a school's *physical security system*, which exists within the protection and mitigation phase of a school safety system, consists of a combination of equipment and technologies, design features, personnel, policies and procedures, and training programs that interconnect to provide security benefits. Figure 4 provides a visual representation of the school physical security system and its five elements.

Although some measures that fall into the five elements included in Figure 4 relate to just one of the three main physical security outcomes of detect, delay, and respond, others can relate to two or even three outcomes. Cameras, for instance, are first and foremost about detection, even though they might enable a timely response if they are paired with effective policies and procedures. Perimeter fencing is related mostly to the outcome of delaying an intruder, as are door lock systems. But training and exercises, as well as physical security policies and procedures, can contribute to all three outcomes of

FIGURE 4
The School Physical Security System



detection, delay of a threat, and response at the same time. Returning to the CCTV example, policies and procedures for assigning personnel to monitor video feeds and response protocols that lay out the steps school staff should take when the camera detects the presence of a suspicious person contribute to the outcomes of detection, delay, and response. The same can be true of well-designed programs for training and exercises.

As was true for certain elements falling under the scope of threat prevention, such as school climate, some physical security measures in place at a school work passively to reduce that school's vulnerability to potential harm by making detection, delay, and response easier—that is, they do not depend on the specifics of an incident to be useful and do not require specific action. Measures that match this description are typically those that are integrated into the built environment or are part of a school's everyday operations—for instance, architecture, landscaping, lighting, or a system that locks classroom doors every time they are closed. *Active measures*, on the other hand, rely on some combination of detection and delay to trigger action and then enable that action to be effective. Policies to ensure the rapid notification and arrival of law enforcement personnel, for instance, will depend on detection and delay capabilities to be effective; without detection, an incident would not trigger response, and insufficient measures to delay will undermine the effectiveness of the response.

Response and Recovery

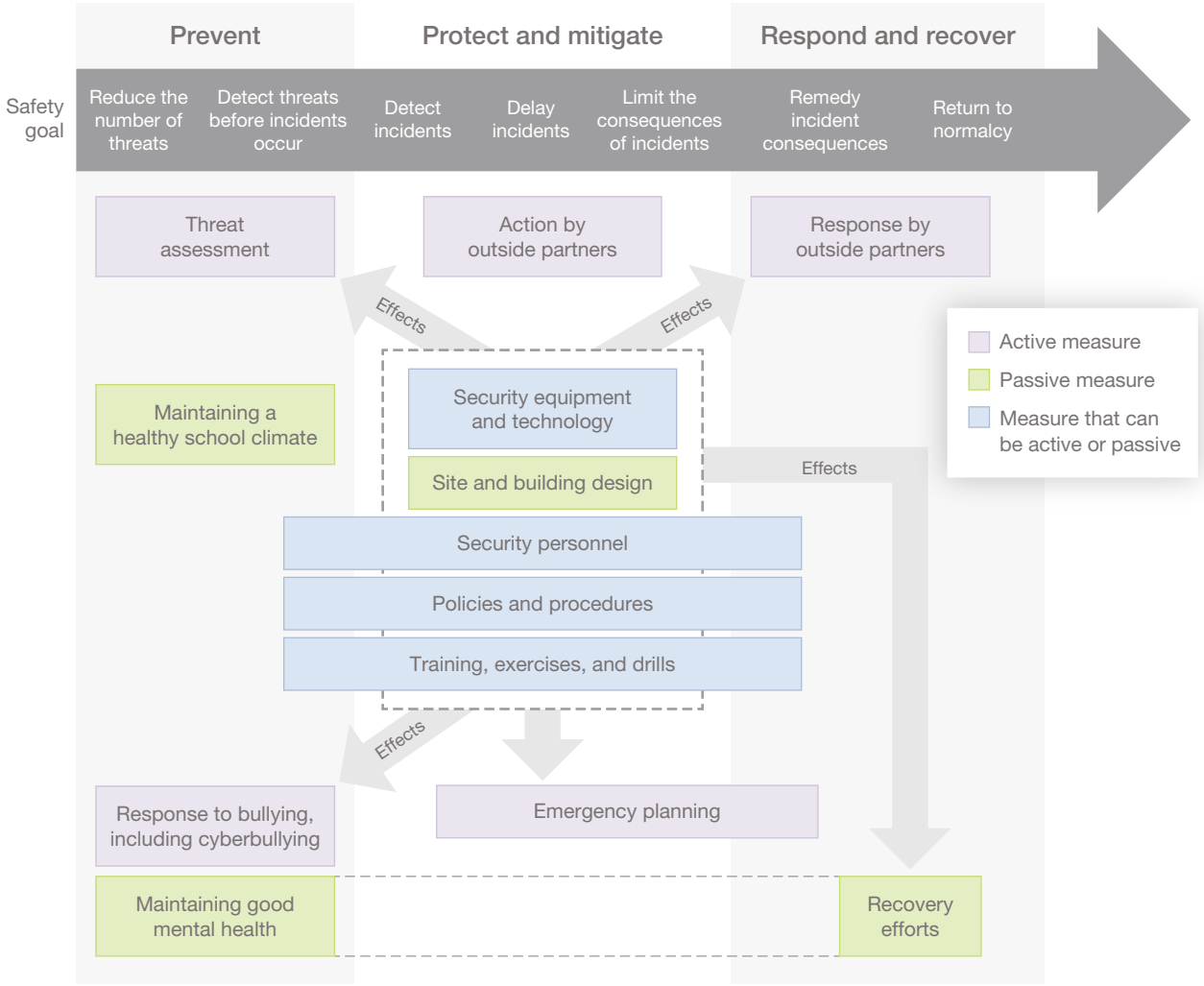
The objective of the response and recovery phase of the broader school safety system is to respond effectively to safety-related incidents and restore day-to-day operations in a manner that meets student and staff needs into the future (SchoolSafety.gov, undated). When addressing response outside of the protection and mitigation space, we shift the focus away from interdiction (which focuses on stopping an incident to mitigate consequences) and more toward actions to save lives in the immediate aftermath of an incident, largely through emergency medical services (EMS).

Logically, there is a clear connection between the physical security outcomes of detection, delay, and response and the response and recovery phase of the school safety system. Effective detection and delay capabilities contribute to timely and appropriate response: If physical security measures can detect threats before or as they occur, as well as delay the progression of an incident, the window of opportunity for an effective and timely response increases. Surveillance cameras installed in school hallways, for instance, help to detect incidents of fighting or vandalism and make it possible for school staff, as well as external stakeholders, such as EMS, to respond quickly after someone monitoring the video feed sends an alert. In addition, physical security policies and procedures not only address how to recognize, or detect, a threat but also provide instructions to school staff and outside responding agencies on the specific set of actions they need to take to respond to an incident. In fact, these types of policies are often the connective tissue that links the prevention, protection and mitigation, and response and recovery phases into a coherent and effective system (Rabkin et al., 2004). Through regular training, exercises, and drills, a school can further ensure that members of its community and external stakeholders (e.g., local police, fire, and EMS) are aware of the protocols and measures in place to protect their school and respond to incidents.

Recovery measures, such as policies and plans to reunite students and parents in the aftermath of an incident, or additional services, such as mental and behavioral health help, can attenuate the traumatic impacts of an event and contribute to rebuilding school climate in the wake of a tragedy or other disruptive event. The Readiness and Emergency Management for Schools (REMS) Technical Assistance (TA) Center provides guidance on how to plan for academic, physical, fiscal, and psychological and emotional recovery in the wake of an emergency (REMS TA Center, undated c).

FIGURE 5

Interconnections Across the School Safety System



Interconnections Across the School Safety Phases

Figure 5 depicts the interconnections between the three phases of the school safety system. The elements shaded in green represent what we call *passive measures*—they do not depend on any intermediate outcomes of detection, delay, or response to be effective. Those shaded in red represent *active measures*—those whose effectiveness does depend on the aforementioned intermediate outcomes. We have also shaded some elements in blue; these are measures that could hypothetically be either active or passive, depending on how they are implemented.

As the figure shows, each type of measure can occur within each of the three phases of the school safety spectrum. Moreover, measures that fall under the scope of protection and mitigation—various equipment and technologies, building design features, security personnel, or specific policies and procedures—can play important roles in or have important effects on elements that fall outside the protection and mitigation space.

As an example of these interconnections, consider an LEA's decision to hire a school resource officer (SRO) (a sworn police officer assigned to a school district or individual school) as part of its efforts to improve physical security.[9] The SRO, although in part responsible for contributing to the intermediate outcomes of detection, delay, and response that fall under the scope of protection and

mitigation, can also play roles in threat prevention and the response and recovery phase of the school safety system. Specifically, SROs could be members of multidisciplinary threat assessment teams if they have skills and expertise specific to educational settings (Colorado School Safety Resource Center, 2018). They can take the lead in criminal investigations and in interviewing individuals as required by the threat assessment process and assist with intervention and threat mitigation by discussing the legal implications of certain behaviors or counseling families on how to secure firearms and other weapons (Kelly, 2018). The SRO also serves as the primary point of contact with other law enforcement personnel; these connections to outside law enforcement and EMS also make SROs critical players in the postincident response and recovery phases.

In the next section, we delve deeper into a systems approach to protection and mitigation, beginning with identifying risk-specific needs and selecting appropriate solutions based on physical security functions.

A Systems Approach to Protection and Mitigation

If applied in the right ways, physical security can contribute to fostering a safe and productive learning environment. Certain security technologies can provide school administrators with otherwise-unavailable or hard-to-get information and free up staff time to focus on more school-appropriate work (Green, 1999). Others can save schools money, either by preventing a particularly devastating incident or by helping schools avoid the need to hire more personnel (Green, 1999). This section explains how LEAs can approach the otherwise-daunting tasks of planning for physical security and selecting the measures, including technologies, that are appropriate for their unique school context.

Assessing Risks to School Safety

First and foremost, school safety is about protecting people—a school's students, faculty, and staff, as well as the visitors who pass through on a daily basis. It is also about protecting school campuses, which typically include buildings, parking lots, sports fields, and other multipurpose outdoor spaces. And LEAs also need to protect information technology and communication equipment; school and student records; and a host of teaching, custodial, and other functions and services. There are thus a variety of safety-related incidents that can be of concern to schools, and identifying and prioritizing protection and mitigation needs accordingly are important to ensuring that physical security design yields the greatest security benefits (Federal Emergency Management Agency [FEMA], 2003).

The hazards, or safety-related incidents, that threaten schools can include

- *natural hazards*, which typically refers to natural events, such as earthquakes, floods, or hurricanes
- technological hazards
- biological hazards
- human-caused hazards that originate from human activity or accidents beyond human control (FEMA, 2003, pp. 1–7; REMS, undated a).[10]

Each has different consequences for a school. Moreover, the frequency of an event, or likelihood that it will occur at a particular school, also varies. In other words, natural disasters and mass shootings are highly destructive but also rare events. On the other hand, trespassing, drug and alcohol possession, fights in the hallways, and disruptive student behavior are more-common occurrences but are unlikely to cause massive disruption to school functions.

To protect against this variety of hazards, a school engages in a security planning process to identify the most-effective protection and mitigation measures that will help it achieve a desired level of protection against a wide variety of hazards (APL, 2016). A first step in systematic security planning is the threat assessment or analysis, during which the LEA identifies the types of safety-related incidents that are a concern for its schools, as well as the extent to which these are likely to occur. Second, a risk analysis helps an LEA determine the potential consequences of each safety-related incident. Third, an LEA catalogs existing protection and mitigation

measures in place across the various layers of a school campus through a vulnerability analysis to determine how these measures reduce the level of risk identified during the risk analysis and how much of that risk remains. At this stage, the LEA is ready to engage in security planning to determine what additional investments, personnel roles, or policies are required to effectively address any residual risks identified in the vulnerability analysis. Figure 6 illustrates this process.

Figure 7 provides a sample schematic that an LEA might use during steps 1 and 2 (threat analysis and risk analysis), with potential school safety–related incidents plotted according to their likelihood and potential impact. Notably, the risk that each of these safety problems poses to a school can vary according to the time of day or location within the school campus or building; a threat rating scale might therefore assign a specific rating to each threat on the basis of its likelihood and potential severity in specific areas of the school or at specific times during the day. Historical data on school safety-related incidents can help inform such a scale. Moreover, many states require the participation of local law enforcement officials and EMS in the school safety planning process; these stakeholders can provide additional sources of historical data on neighborhood crimes and disturbances relevant to assessing risk to a school and ensure that safety plans will not conflict with existing local emergency-service protocols (see, e.g., FEMA, 2020, and Keyes et al., 2020). We discuss external-stakeholder engagement in more depth in later sections of this report.

Identifying the Appropriate Physical Security Functions and Needs

Physical security measures are most effective in combination with other measures as part of a layered system (Jackson and LaTourrette, 2015). A CCTV system might offer potent detection capabilities that can cover wide areas, but, if no one is watching the video feed or the camera does not trigger an alarm, these capabilities are nonexistent. Indeed, detection capabilities combined with response capabilities have tangible protective value, meaning that, together, they make it more difficult for a potential attacker to execute their plan. In this sense, it is useful for LEAs to think about physical security functions in conjunction with their security needs as identified in a risk assessment (e.g., what specific result does a school seek from its investments into physical security and from specific countermeasures, and what utility does a measure or combination of measures provide in terms of protection?).

Different security measures also perform their various functions at each layer of a school campus: Perimeter-control measures, such as fencing at the edge of school grounds, offer access control at the outermost layer, while security cameras installed in the parking lot provide detection capabilities one layer deeper, within school grounds. Specific proce-

FIGURE 6
The Threat–Risk–Vulnerability Analysis Process for School Security Planning

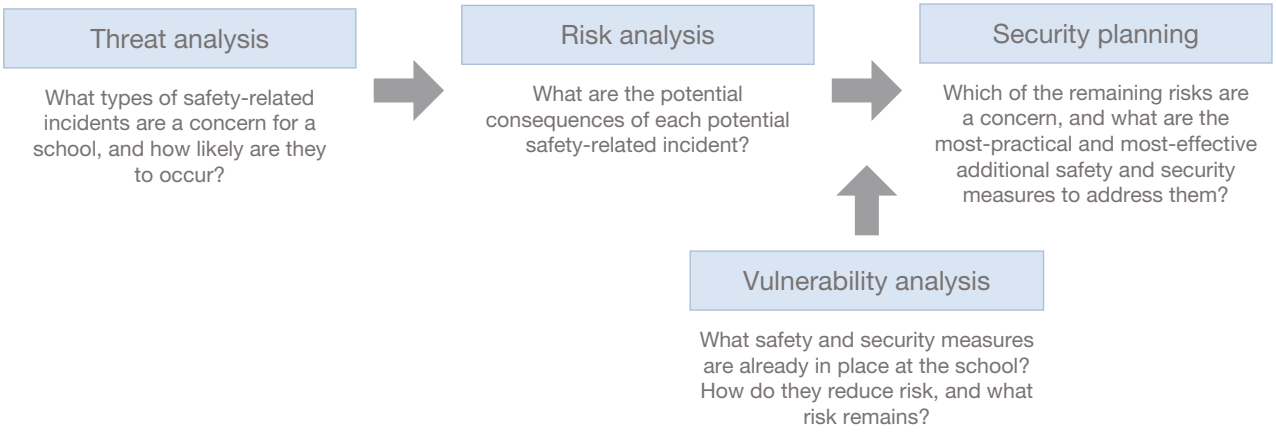
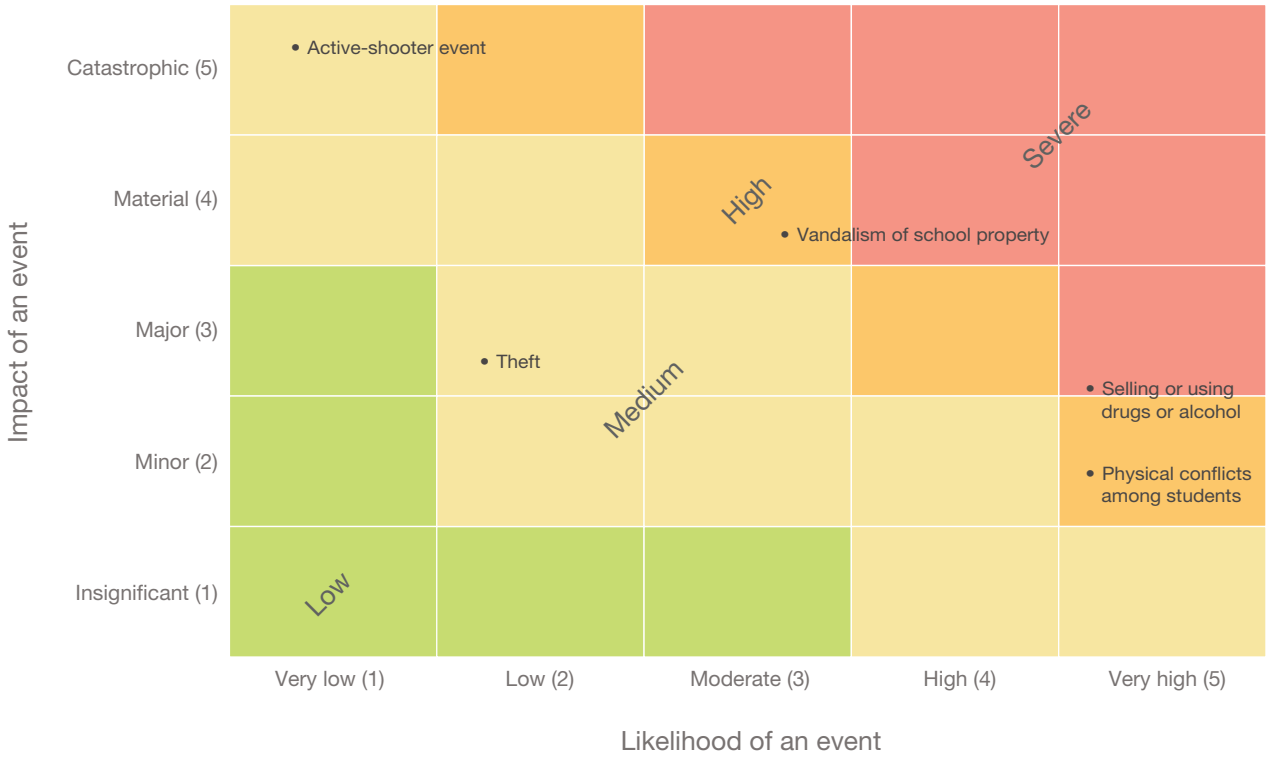


FIGURE 7

Example of a School Threat Analysis



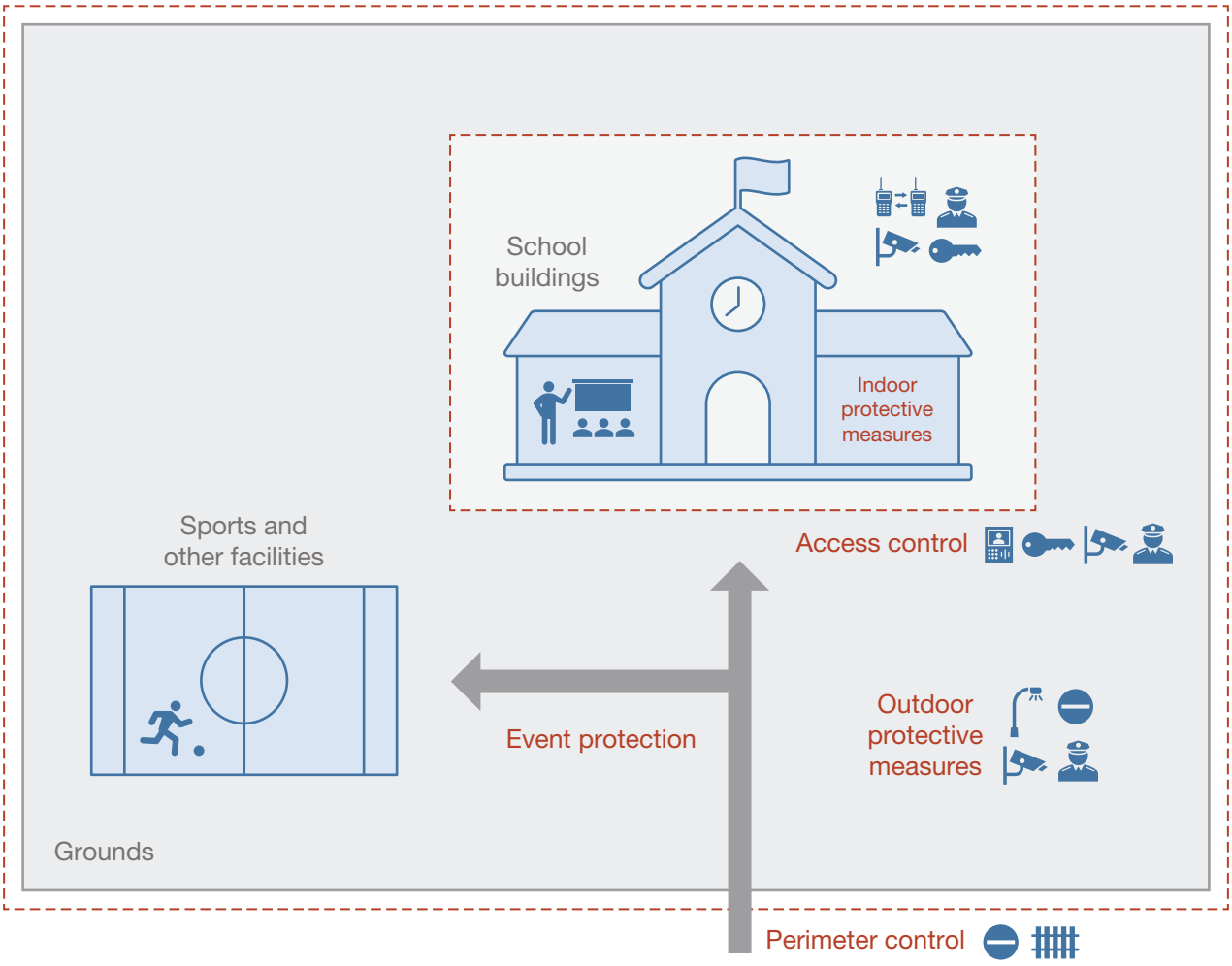
SOURCE: Adapted from APL, 2016. School safety–related incidents included in the figure are plotted according to statistics provided by NCES on school and school neighborhood problems. See Wang et al., 2020.

dures and policies regarding locked doors inside the school building provide yet another layer of protection. Systems that are organized into layers contain interconnected supporting elements that help prevent gaps in protection and mitigate single points of failure within the system (Doss and Shepherd, 2015, p. 147). In such systems, physical security measures, design features, personnel, and policies have specific functions based on whether they are selected to protect a school's grounds perimeter; the area within school grounds but outside school buildings; a school building itself; or the areas within school buildings, such as classrooms, hallways, common areas, or administrative offices. Figure 8 provides an example of a layered approach to school physical security.

The way in which a school achieves a given physical security function will also depend on school-specific factors. The layout of a school, as well as its physical location, will dictate the relevance of particular layers in providing security benefits. A school with an open campus and portable classrooms, for instance, will need to prioritize physical security at the school-grounds, building-perimeter, and building-interior layers and invest less in measures designed to provide protection at the campus perimeter. By contrast, a closed-campus school might shift some resources away from securing its grounds in favor of investing in fencing, signage, and security cameras placed at entrances located at the campus-perimeter layer.

Other context-specific factors will also affect how a school plans and implements its protection and mitigation system. School staff working in a small town, for example, might know virtually every student enrolled at the school, as well as their parents; deciding on who may and may not enter the school might thus be as simple as relying on that local knowledge. In a larger school, on the other

FIGURE 8
Layered School Physical Security



hand, such levels of familiarity are unrealistic, and school staff might need to rely on technological access-control measures, such as databases of people authorized to pick up students or identification (ID) scanners at the front entrance.

In short, our analysis suggests that LEAs will need to think through the following questions as they plan for security across their campuses:

- What are the threats likely to enter a school environment, and where are threats likely to enter?
- When would these threats be detected by the existing security measures in place?
- How would existing measures that are already in place delay these threats, and for how long?
- What policies or measures are in place that would allow adequate time to respond to an incident?

The answers to these questions will be specific to individual schools and school districts. In some areas, response from police might only be a few minutes away or even exist within the school if an SRO is present. For other schools, such as some in rural settings or highly congested areas, police response time might be so long that any incident is likely to be over before responders arrive on the scene. Alternatively, a school's immediate area might make perimeter control impossible, or a school that has already invested heavily in detection (e.g., CCTV) might find that it needs to focus on other elements to leverage the existing technology to improve protection

and mitigation outcomes. Ultimately, these details will shape what is needed to improve security across diverse school settings—to *increase* the likelihood that a threat will be *detected*; *further delay* a threat to increase the opportunity to respond; and *expand options* to stop or reduce the impact of an incident.

Elements of the School Protection and Mitigation System

Physical security in U.S. schools reflects diverse combinations of ingredients that come together to form a system offering protection and mitigation against various types of risk. Indeed, a school's layered approach to security should reflect the unique features and needs of that particular school, such as its location, the size of its student body, patterns of local crime, and community buy-in. Schools also have different budget constraints, and the cost of equipment and technologies could be prohibitive for many. As a result, some schools might place more emphasis than others on the development of policies and procedures around security before making significant technology investments. But investments in one area—for example, asking teachers to assist with searching student backpacks—typically require making trade-offs in others—in this case, time for instruction, lesson planning, or staff professional development. The rest of this section provides more-detailed guidance on how an LEA can approach building protection and mitigation systems in a way that meets its unique needs.

Security Technology and Equipment

Schools have become the focus of a $3 billion security industry (Keierleber, 2018). Beginning in the aftermath of the 1999 school shootings at Columbine High School in Colorado, technology vendors have approached schools with a multitude of increasingly sophisticated and costly options to "harden" their campuses. Some measures, such as door bolts, fall on the lower end of the cost spectrum, whereas others are high cost because of the integration of more-sophisticated technology; examples include surveillance cameras with facial-recognition capability, automated door locks, gunshot detection sensors, and software that scans social media platforms in search of specific information (Keierleber, 2018).

Since 1999, more and more schools across the United States have turned to monitoring and locking down their campuses via technology: The use of video surveillance has grown from just under 20 percent of schools during the 1999–2000 school year to slightly over 80 percent during the 2017–2018 school year. During the same school year, more than 95 percent of schools across the United States had installed locking or monitored door systems inside their buildings and across school grounds (NCES, 2019). Littleton Public Schools, a district neighboring Columbine High School's district and that itself experienced a shooting in December 2013, installed more than $7.5 million in security upgrades after community members approved a bond that same year (Grace, 2017).

With each technology choice comes a host of associated questions and requirements. Some pertain to additional technological requirements and integration with existing equipment, others to cost, and still others relate to human resource needs, policies and procedures, and training. Understanding technologies' technical and other specifications can help to answer many of these questions. Consider, for instance, that some door lock systems require CCTV and an intercom; investing in just the door lock itself might be insufficient and ineffective in securing a space (Casella, 2010). Moreover, door locks will not be useful if the entrances they are intended to protect are located next to nonreinforced, accessible windows; Sandy Hook Elementary School's main door was locked, but the gunman shot through a window near the front entrance to gain access to the building's interior (Sandy Hook Advisory Commission, 2015). Alarm systems also come with a host of technical requirements; when choosing one, an LEA should also consider how sensors will transmit information to the alarm (for example, via radio transmission, hard-wiring, or the internet), how the alarm will convey an emergency signal, and what kind of backup power source needs to be in place in the case of blackouts or hardware failures.

Integrating new and existing security equipment and technology is crucial for avoiding single points of failure and a valuable cost-saving strategy. When equipment and technology are integrated, they link together and work as a whole; integration is as much a conceptual as logistical challenge and can proceed in phases (Rabkin et al., 2004). In a school context, technology integration might mean linking multiple technologies together (for example, an attempted unauthorized access triggers video camera surveillance and an alarm) or making it so that one piece of equipment automatically identifies suspicious activities by flagging anomalies to relevant decisionmakers who can then coordinate action. Integration can also be as simple as connecting an intercom into a school's existing telephone system so that staff can make both schoolwide and selective announcements.

One of the greatest challenges to school physical security is the cost associated with technology and equipment (Steiner et al., 2021). The equipment and technology that a school selects to protect and mitigate risk should be justifiable from a cost perspective and fit within budget constraints and staff skill sets (Bahr et al., 2007). Often, investments in security technology will require financial trade-offs in other areas and reduce the budget available for equally important and effective safety measures, such as violence-prevention programs (Schwartz et al., 2016). Costs also accrue as a school needs to maintain any security technology it has in place; any investment will need to account for regular equipment maintenance, repairing or replacing faulty equipment, and updating any software that is required for the technology to work as intended.

To prevent such budget shortfalls, an LEA should first consider what it can achieve via the implementation of less or least costly approaches to improve school security. For example, a school or district with limited resources might choose to post signs detailing a school's If You See Something, Say Something® policy in areas where it is unable to install surveillance cameras and install lighted exit signs and associated posters that clearly and succinctly detail school evacuation procedures (Doss and Shepherd, 2015, p. 119). It is also worth noting that the National School Safety Center suggests that intervention by school administrators, teachers, and staff is more likely than most technologies to effectively identify students at risk of committing an offense (APL, 2016); costly technology investments might therefore be unwarranted if the main purpose is to prevent violence. Other alternatives to hardening school campuses via equipment and technology might include asking parents to donate their time to volunteer programs and assigning staff to monitor parking areas, playgrounds, and interior spaces in shifts (ASIS International, undated). Not only are such approaches more cost-effective than installing additional cameras; they also reduce the sometimes harmful "visibility" of protection. Policies and procedures, as well as staff training, can be especially effective complements or alternatives to security equipment and technology if they are well-communicated and consistently applied (School Security Task Force, 2014).

Intervention by school administrators, teachers, and staff is more likely than most technologies to effectively identify students at risk of committing an offense.

Equally important is the notion that physical security measures, such as surveillance cameras, automated alarms, metal detectors, and other technologies, are not failproof—they are often subject to human error and can have unintended consequences. In Parkland, Florida, for instance, emergency personnel did not realize that the school's surveillance cameras were operating on a 20-minute delay, which complicated the police response to the shooting in February 2018 (Marjory Stoneman Douglas Public Safety Commission, 2019). Surveillance cameras can

also have the adverse effect of displacing illicit activity to unmonitored sections of a school campus or to off-campus locations and thus beyond the reach of school's direct area of influence.

The literature on school physical security also raises concerns about technology's potential to violate student privacy and civil liberties, as well as those of school teachers and staff (Heinen et al., 2007). Facial-recognition technologies pose a particularly significant risk in this regard and have the potential of further aggravating existing racial biases in school discipline: Studies show that the technology is more inaccurate when it comes to identifying people who are not white (Grother, Ngan, and Hanaoka, 2019) and could therefore increase the odds that students who are not white will be punished for offenses they did not commit. Along similar lines, civil rights groups and other critics have raised concerns that Black students and Hispanic students were more likely than other students to report attending a school with pervasive security measures (Steinka-Fry, Fisher, and Tanner-Smith, 2016, p. 431). Privacy concerns can also surround ID card systems, such as those using radio-frequency ID, that track a student's location and retrieves personalized information (Casella, 2010).

Student responses to certain security technologies are another important consideration for LEAs. Some studies, for instance, show that students are likely to perceive measures differently depending on where and how the measures are implemented. Whereas students might perceive cameras installed outside of school buildings—for example, in parking lots—as tools to keep them safe, they feel as though they are being treated as perpetrators when schools install surveillance cameras inside school buildings (Johnson et al., 2018). And other studies show that surveillance, broadly speaking, instills in students a feeling that their schools are unsafe (Tanner-Smith et al., 2018). Students also respond to surveillance in various ways of resisting it, such as feigned conformity, concealment, or countersurveillance (Hope, 2010).

In sum, certain physical security technologies can provide some of the latest information about the state of safety within a school and are desirable insofar as they relieve some of the burden placed on school administrators, teachers, security personnel, and other staff. But the literature also shows that technology has its limitations when it comes to identifying potentially violent offenders in schools and can introduce significant challenges insofar as violating students' and others' privacy and civil rights. In many cases, early intervention by school administrators, teachers, and staff might be a more effective solution. Each LEA should evaluate whether equipment and technology are the most-effective use of its security dollars and how policies and procedures, as well as appropriate staff training, can maximize their potential safety benefit while avoiding unintended adverse consequences.

Site and Building Design

Deciding how to integrate physical security into school site and building design is a daunting task. For new construction, choices made around the overall layout of the school—including those around school safety and security—will steer subsequent decision-making. For example, an LEA involved in planning for the development of a new school could be confronted with the decision of whether school functions will be clustered or dispersed. Although concentrating key functions in one place on a school's campus can create a "target-rich" environment and establish more single-point vulnerabilities, it can also create more "defensible space" and help reduce the number of access and entrance points necessary (Philpott and Kuenstle, 2007, p. 30). Dispersing school functions, for instance by installing portable instructional buildings, can mitigate single-point vulnerabilities but also reduce the effectiveness of certain technologies, such as CCTV, and increase the complexity of emergency response mechanisms (Philpott and Kuenstle, 2007, p. 30).

An LEA might also need to decide on other issues related to site or building design, such as the orientation of a new school building (e.g., how close a building's facade will be to the parking lot, street, or adjacent businesses); the incorporation of open space into school site design; and how school infrastructure will receive power, gas, water, and other critical services. Schools will also need to take into account various structural design considerations (including

Schools need to maintain a welcoming environment as they work to secure their campuses.

roofing) and architectural elements, such as ceiling and partition design; building design features, such as how buildings are organized across a campus and internally; the number of location of points of entry; and the configuration of courtyards and outdoor walkways (Doss and Shepherd, 2015; FEMA, 2012; Sandy Hook Advisory Commission, 2015).

Unlike certain types of facilities, such as correctional facilities or military installations, schools need to maintain a welcoming environment as they work to secure their campuses. Other public and semipublic spaces, such as houses of worship, face similar challenges as they strive to maintain open, yet secure, atmospheres (DHS, 2013). Crime Prevention Through Environmental Design (CPTED) is an approach that contributes to this objective and has regularly been applied to school safety and security design (see, e.g., Fennelly and Perry, 2014; Barone, 2019; REMS TA Center, undated b; Walker and Eaton-Walker, 2000; Division of Violence Prevention, 2017). Its multidisciplinary nature is intended to deter crime through the built-in, social, and administrative environments (International CPTED Association, undated) and offers a wide variety of options that address site design (landscaping and other building exterior features); building design (entrances, lighting, and other features); interior space design (e.g., lobbies, classrooms, hallways); the installation of accompanying systems and equipment, such as alarms and surveillance; and the broader community context (Atlas, 2013). CPTED approaches offer a variety of site and building design options relevant to schools, such as perimeter fencing to deter trespassers; single points of entry; vestibules or double entries; and minimal glass in classrooms, hallways, offices, and other areas of a school building.

If properly integrated, CPTED approaches can offer a school multiple security and safety advantages without making it look like a fortress; they are intended to make people feel safer while also increasing opportunities for natural surveillance (Minnich, undated). Fencing, for instance, can clearly designate school-grounds boundaries, enable surveillance by school staff, and limit access to areas that are not highly visible to school staff. It can also be designed in a way that does not diminish the aesthetics of the grounds; avoids attracting new forms of crime, such as graffiti or other vandalism; and avoids impeding first-responder access to school grounds in the case of emergencies (Hanover Research, 2013). Architects have pointed out that, inside the school building, simple design strategies, such as moving a counseling wing to areas near where students are located—such as commons or libraries—can make them more transparent and decrease their stigmatization: "Design can . . . allow us to build softer schools—places where kids don't feel disenfranchised and lost" (Flynn, 2018). Lazy-S entrances, such as those often used in airport bathrooms in the place of door entrances, make it impossible for someone to lock or barricade themselves into enclosed areas to commit a crime (Dorn et al., 2014), and replacing solid doors with doors that feature air vents allows for better audio monitoring. So-called soft measures, such as welcoming decor (e.g., murals, student artwork, bright color schemes), have the added benefit of improving school climate and culture while also enhancing perceptions of safety and saving schools money relative to investments in expensive physical security technology (Dorn et al., 2014). These types of design features complement the more-traditional security measures, such as electronic access-control systems, video intercoms, door hardware, and panic buttons, covered in the previous subsection (Fennelly and Perry, 2014).

There are, of course, trade-offs to incorporating certain CPTED and other features into physical security school site design. For example, although putting windows in areas that overlook student bicycle racks might reduce bicycle theft, the windows leave the interior space more vulnerable to burglar-

ies unless they are glazed or otherwise reinforced or lockable. Similarly, the integration of large, open spaces that maximize line of sight might help to deter some forms of crime and increase the chances of detecting intruders but also leave students and staff more vulnerable in the case of an active-shooter event. Indeed, guidance on education facility security design acknowledges that "open circulation and open spaces, which are desirable for conventional school design, are often undesirable for security design" (Philpott and Kuenstle, 2007, p. 28). Shooters can also easily shoot through areas with windows, secondary entrances, and even walls if these are not reinforced with ballistic protection (Philpott and Kuenstle, 2007).

Ultimately, the purpose of CPTED approaches to school safety and security is to discourage a wide variety of types of misconduct on school property because site, building, and interior design features make crime and violence more observable and increase the likelihood that students, staff, and teachers will act on what they see (International Association of Chiefs of Police, 2012). A main barrier to the implementation of new site and design features is, of course, the cost associated with new construction and renovations and retrofits. In fact, measures that fall under the scope of the site and building element of a school's physical security system are likely to be significant financial investments for schools (McIlhatton et al., 2020). As our companion report discusses in detail (Steiner et al., 2021), retrofits will also need to comply with any existing local building rules and regulations, such as fire codes, and integrate with existing school infrastructure; these requirements could further elevate design costs. Often, it is easier to incorporate new site and building design features into an altogether new school or campus than to fit these new designs into existing structures (Green, 1999; National Center for Spectator Sports Safety and Security, 2020).

The Human Component of Physical Security

Not only do people operate many of the security equipment and technologies for schools; they are also responsible for designing policies and procedures to use that equipment in service of school safety. Moreover, adding new personnel is often the costliest operating expenditure an organization will face; therefore, decisions in this area are particularly sensitive. As a result, many organizations—including schools—maintain only small numbers of personnel assigned exclusively to security work (National Academies of Sciences, Engineering, and Medicine, 2015). Fortunately, a variety of options exist when it comes to hiring security personnel or assigning security-specific roles and responsibilities to school staff, such as relying exclusively on local law enforcement, hiring off-duty police officers, contracting private security personnel, and assigning school staff or volunteers to monitor hallways and common areas.

As of 2018, 84 percent of high schools, 80 percent of middle schools, and 51 percent of elementary schools across the United States had some type of dedicated security staff (Wang et al., 2020). Although law enforcement agencies have historically coordinated with schools, the past 20 years have seen a significant increase in police serving full time inside schools (Raymond, 2010). The placement of security personnel in schools—in particular, armed security personnel—has drawn considerable public controversy. Some large school districts across the United States have created their own police departments,[11] although the most common model has been for LEAs to rely on a combination of SROs and coordination with local police departments.

The main responsibility of an SRO is typically to maintain physical safety within a school. Most take on three roles:

- They provide expertise on safety and enforce the law within school boundaries.
- They serve as informal counselors and mentors to students.
- They educate students about issues of safety and security broadly speaking (National Association of School Resource Officers, undated). However, there is important variation in the actual roles and functions of SROs, due to such factors as the needs of individual schools, the personality of the SRO, and the working relationship between the SRO and

school administrators (Canady, James, and Nease, 2012).

Despite their prevalence in contemporary U.S. schools, the benefits of SROs are contested in the literature: Some studies show that they serve as deterrents to violence in some contexts but, in others, might have adverse effects on school climate and student perceptions of safety (see, e.g., Bachman, Randolph, and Brown, 2011; Crawford and Burns, 2015; Gonzalez, Jetelina, and Jennings, 2016). Part of this discrepancy is likely due to significant variation in the school- and SRO-specific factors noted earlier, as well as other factors, such as student age and demographics. For example, although SROs are linked to the occurrence of fewer violent attacks in elementary and middle schools, the effect does not hold at the high school level (Crawford and Burns, 2015). Other studies have found that white students are more likely to view SROs as a safety benefit than students who are not white do (Pentek and Eisenberg, 2018). Nascent SRO programs in particular are sometimes ineffective because schools new to these arrangements are unsure how to manage and integrate officers into their broader school safety approach, and their security plans fail to sufficiently specify SRO roles and responsibilities. In other instances, SROs have not had a positive effect on safety because the SRO position has gone largely unsupervised. Establishing SRO monitoring and evaluation programs and memoranda of understanding that identify clear roles and responsibilities can attenuate many of these challenges (Federal Commission on School Safety, 2018, p. 102; Finn et al., 2005).

Alternatives to SROs and law enforcement in schools include involving nonsecurity personnel in school safety and security. For example, LEAs have the option of organizing school staff into shifts to serve as hallway monitors—this can be effective in reducing low-level violence, such as bullying, and, in some cases, can be even more effective than hiring security personnel. Research shows that, with the proper guidance and training, engaging regular school staff in day-to-day security roles can be an effective alternative to otherwise-costly solutions that rely on technology or additional personnel and can add value in the way of building trust between staff and students (Addington, 2009; Blosnich and Bossarte, 2011; Goodrum and Woodward, 2019; Schwartz et al., 2016).

Building the System: Policies, Procedures, and Training on Protection and Mitigation

A systems approach to protecting and mitigating against school risk brings a synergistic and inclusive view to planning and implementation, taking into account all five elements depicted in Figure 4 (technology and equipment; site and building design features; personnel; policies and procedures; and training, exercises, and drills). We emphasize in this section that the policies, procedures, and training developed around physical security tie together people and personnel with equipment, technology, and design to build a coherent system.

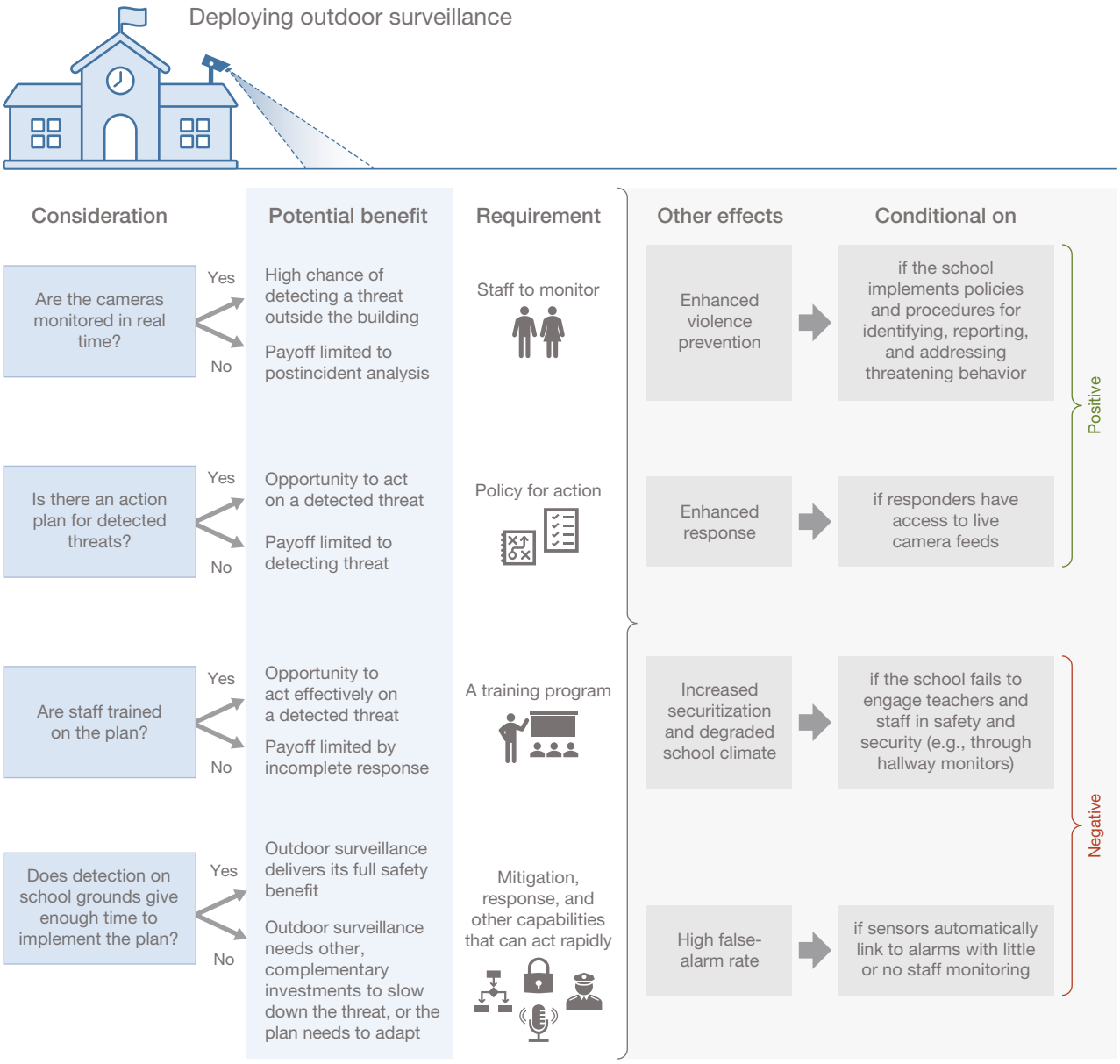
Consider the flow diagram of deploying outdoor surveillance in Figure 9. The technology choice made by the LEA in this particular example—placing surveillance cameras in a school parking lot—leads to other requirements to ensure that the investment yields a safety benefit. Specifically, cameras require three accompanying elements if they are to detect a threat and allow for an adequate response: staff to monitor the camera feed and detect potential threats; a policy outlining the actions school personnel will take if a threat is detected; and a training program that walks school staff and students, if appropriate, through these actions so they have the opportunity act if a threat is detected.

Policies and Procedures

Together with training and exercises, which we discuss in the next section, a school's policies and procedures for safety and security hold together its physical security system (REMS TA Center, undated a). Without them, the utility of measures and technologies, of hiring security personnel, and of safety-specific design elements on school campuses could decrease significantly. Students, teachers, and staff need to know what to do in the event of an

FIGURE 9

An Example of a Systems Approach to Physical Security: Outdoor Surveillance



emergency or know how they can report a criminal or violent act when they witness one.

Some safety- and security-related policies that schools have in place are mandated by their states or localities. As our companion report, *Challenges to Implementing Physical Security Measures in K–12 Schools* (Steiner et al., 2021) discusses, LEAs should be aware of what is required at these levels. Some states, for instance, require law enforcement agencies to establish and maintain policies and procedures on school safety that address such issues as active-shooter response, school lockdowns and evacuations, and providing public information during an event. Many state departments of education provide their own variants of such policies—for example, by advising that school officials consult with law enforcement to ensure that their own policies are aligned with state-issued directives and regulatory requirements (School Security Task Force, 2014).

There is no one-size-fits-all policy to protect against and mitigate a specific type of risk or set of risks. Beyond what is mandated by state and local authorities, each school must determine what additional policies, rules, and procedures will best fit its individual needs and the needs of its distinct school community. Policies as they pertain to protection and mitigation—for example, hallway or parking lot monitoring procedures, door tailgating or locking policies, and camera monitoring policies—should be standardized and comprehensive; cut across physical security technologies and design features in place at the school; and integrate into other policies that are in place for prevention, response, and recovery. This has two particularly important implications:

- First, every school should put in place the necessary policies and rules to ensure that any technology it installs functions as intended. For instance, a policy stipulating that classroom doors should be closed and locked from the inside while classes are in session should be implemented only with the actual installation of interior locks on classroom doors. And, as Figure 7 implies, policies about who will monitor security camera feeds, and what the appropriate actions will be in the case that a camera detects an intruder, are critical if the technology investment is to yield safety benefits. Policies should also detail how long into the future a school will keep CCTV camera footage, and who will have access to it (APL, 2016).
- Second, this means that LEAs should think about how policies and procedures around protection and mitigation interact with other elements of the school safety system—namely, prevention and response and recovery—and possibly affect the privacy and other rights of students and school staff. For example, an LEA should think through the set of procedures that need to be in place when a school threat assessment team identifies a student's behavior as a potential threat:
  - To whom is this information communicated?
  - To what services and support will the student have access?
  - What precautions might be necessary, if any, when that student is on campus?

This should also include procedures for when and how to share information with law enforcement and other schools or having policies in place allowing parents to participate in behavioral threat assessment and intervention programs if school leadership believes that it is necessary (see, e.g., Illinois Terrorism Task Force [ITTF], 2018). Bag- or locker-search policies might violate students' civil liberties, as might random sweeps for contraband; these types of policies amount to suspicionless searches (Addington, 2009). Even seemingly harmless security procedures, such as certain visitor-screening policies, can pose civil liberty and privacy concerns for members of a school's community. For example, some parents or other school visitors might be reluctant to show government-issued ID insofar as doing so could reveal sensitive personal information, such as immigration status. LEAs should keep these concerns in mind as they develop policies and procedures to improve security.

Another main advantage of well-planned and consistent school policies, rules, and procedures for physical security is their low-cost nature; many have no acquisition costs and do not require monetary expenditures yet can have a strong impact on overall safety and security as stand-alone protection and mitigation measures (ITTF, 2018). Policies

There is no one-size-fits-all policy to protect against and mitigate a specific type of risk or set of risks.

for the management of school doors and entrances, for example, such as no-propping and no-tailgating policies, as well as assigning teachers and staff to entrances during school drop-off, can prevent the entry of unauthorized people and do not require the purchase of sophisticated technology or hiring of additional security personnel. Asking that every visitor present an official form of ID and fill out a sign-in sheet is another simple and low-cost access-management strategy (Fennelly, 2017; Timm, 2015). But different types of costs will accrue as schools put in place policies that require substantial staff time. For instance, a policy requiring that school staff search backpacks as students enter the school would have significant costs in terms of staff time and could reduce time for instruction if the search procedures became too time-intensive.

Finally, it is worth noting that policies and procedures should also account for after-school hours; operations should not cease when students get out of school at the end of the day. Practices and procedures that address building access, emergency evacuation, security personnel, and EMS should therefore also apply to athletic events, school board meetings, student concerts and performances, after-school care, and other events that occur in the late afternoon or evening and on weekends, as well as during the summer months (see, e.g., National Center for Spectator Sports Safety and Security, 2020).

Training and Exercises

Training in protection and mitigation completes the physical security system; the four other elements are unlikely to be effective without regular training on how to use the technology, apply the policies, and employ personnel (REMS TA Center, undated a). Members of the school community should know their roles and responsibilities during emergencies and during the school day when they see certain behaviors: Students should know who to go to if they see a threat and how to evacuate their classrooms or where to stand so they will not be visible in the event that their classroom is locked down, and teachers and staff should be familiar with how they will respond to an emergency. A useful way to increase awareness of respective roles and responsibilities is through training and exercises that familiarize staff with equipment and technologies; help validate and reinforce the policies and procedures in place; identify where more work is needed; generate buy-in from the broader school community; and help strengthen relationships between the school and community partners, such as local fire and EMS (see, e.g., FEMA, 2010).

A school's safety and security training program should match the technologies it has installed to protect its campus; teachers and staff should know how to properly use, maintain, and update the physical security equipment in place throughout the school. Vendors can provide technology-specific training, and members of the law enforcement and first-responder communities can provide training on specific responses, such as lockdown and evacuation procedures (Schneider, 2010). Training also helps to ensure that teachers and staff are aware of equipment technical requirements, know the people to whom they should report equipment delinquencies or shortfalls, and whether policies for the use of particular technology need to be updated.

Training on school safety and security is delivered in myriad ways, and best practices call for involving the entire school community—security personnel, teachers, administrators, and students (Federal Commission on School Safety, 2018)—as well as external stakeholders, such as local police and fire first responders, whom we discuss further in the next section. Training is most likely to be effective when it does not become another burden placed on the school community. Running exercises and drills can become time-consuming and expensive if schools create overly complex training regimens or do not prioritize needs. Instead, training should be based on easy-to-learn, easy-to-remember, and easy-to-use strategies that promote a safe and secure school environment (ASIS School Safety and Security Council, 2016).

LEAs have approached this challenge in a variety of ways. Some, for instance, have developed series of short online courses that prepare teachers and staff for emergencies by detailing common procedures (see, e.g., Montgomery County Public Schools, undated). Many others schedule practical drills and exercises to occur periodically throughout the school

Best practices for training on school safety and security call for involving the entire school community—security personnel, teachers, administrators, and students—as well as external stakeholders, such as local police and fire first responders.

year. Some states mandate that schools implement such drills regularly, on the basis that it is not sufficient to just tell people what to do in case of a crisis; giving students and staff regular opportunities to practice what is required of them during otherwise-rare emergency situations is important to ensuring the functionality of the overall system.[12] When students, staff, and teachers have the chance to walk through required procedures during simple drills, such actions as hiding under a desk or moving to a specific corner of the room become easier to remember (ASIS School Safety and Security Council, 2016).

Drills and exercises should use developmentally appropriate language to avoid inducing any additional anxiety for students, and plain language is often more effective than using code words whose meaning can be misconstrued or difficult to remember (Foley, undated).[13] For elementary school students in particular, teachers and administrators have framed drills as efforts to build on foundational skills already being taught in the classroom, such as moving together quickly without pushing, staying quiet, and obeying directions from the teacher (Hamblin, 2018). Teachers might also need to take a more hands-on approach to drills with younger children by, for example, helping them get to safe spaces (Schildkraut, Nickerson, and Ristoff, 2020). Experts also advocate promoting collaboration and consensus in the response phase and increasing school staff awareness of best practices in emergency response by including local law enforcement and other emergency responders in such drills and exercises (ITTF, 2018).

Across schools, diverse student bodies and staff will have unique training needs. Effective training for older students, for instance, can take an "option-based" approach that reflects the diversity of a school's population: For example, drills and exercises can incorporate flexibility that allows educators and students with different mobility needs, language abilities, and disabilities to take different actions in the context of specific situations. Such an approach might be less useful in an elementary school context, however, in which students are too young to make these types of decisions on their own and do better with clear guidance and instruction. In short, each LEA should continuously adapt training to match the developmental needs of its student populations (National Child Traumatic Stress Network, 2018).

Finally, it is worth noting that temporary staff will also need training: Substitute teachers, for example, have a role to play in enhancing school safety and security on the days that they are working, and they need to be aware of relevant policies and procedures, as well as what their responsibilities will be in the event of a crisis. If a school faces high turnover rates among its teachers or administrators, it will also need to consider how to regularly integrate new personnel into physical security planning (Timm, 2015).

In sum, building a physical security system requires linking together equipment, technology, and design features through people, policies, and training. Investing in technology alone without specifying associated personnel roles, policies to operate and maintain the technology, and a training program on how to use the technology will fail to bring expected safety benefits.

Engaging External Stakeholders

Engaging with external stakeholders—in particular, members of the law enforcement and emergency-responder communities—is key to ensuring that a school's physical security system is established in a such a way that enables prompt and effective response. Engagement with local police, fire, and EMS officials begins during the security planning process and extends through the implementation of various protection and mitigation measures and into training and exercise programs that help to maintain a school's approach to safety and security. For instance, a school will be better prepared to respond to emergency situations if police and EMS are aware of the types of protection and mitigation measures it has in place.

Engagement can take a variety of forms. Some schools have chosen to put in place a memorandum of understanding or mutual-aid agreement between responding agencies and school administrators to clarify response protocols and when and how they might share video footage from security cameras with local law enforcement (Keyes et al., 2020). Some schools have also issued key fobs to first responders to ensure that they can enter locked areas during emergencies, for instance, or mobile situational-awareness devices, each consisting of a handheld unit that is capable of being networked directly into schools' emergency call boxes. With these technologies, law enforcement and EMS personnel can directly access all areas of a school building and remain aware in real time of where on-campus emergencies are occurring (Ergenbright and Hubbard, 2012). More generally, law enforcement and first responders should have knowledge about school lockdown directives, what spoken commands the school is using to direct students and staff to take various measures, where shelter-in-place locations are throughout the school, and other pertinent details that might affect response and recovery (Goodrum and Woodward, 2019).

Adopting a persistent collaborative training approach based on regular contact with local or regional responders, as well as other stakeholders, such as public health or American Red Cross officials, is crucial to effective protection and mitigation; a plan on which staff and students remain untrained and unpracticed has, at best, a 50-percent chance of being successful when emergencies do occur. When working with first-responder communities to plan, enact, and train to proficiency, schools should place emphasis on tabletop and real-time exercises that allow them to capitalize on the advice, services, and expertise that these partners can provide. A variety of detailed resources exist to help LEAs design strategies to engage local police, fire, and EMS partners (see, e.g., Keyes et al., 2020).

Summary of Findings and Implications

The approach to protection and mitigation that we highlight here rests on the notion that the policies, procedures, and training developed around physical security tie together people and personnel with equipment, technology, and design to build a coherent and layered system. More specifically, making decisions about security technology also requires making critical decisions about the role of personnel in the security process, the policies and procedures that will be in place to ensure the effective and sustained use of equipment and technology, and how training programs and engaging with outside stakeholders can contribute to positive security outcomes.

Notably, our approach also stresses that relying on protection and mitigation alone is insufficient to enhancing school safety and security; physical security is but one of three components of a broader school safety system that also includes prevention and response and recovery. In other words, a secure school is one that promotes a healthy school culture and climate, protects its community from threats and adverse events, and maintains the capacity to respond effectively to and recover from safety-related incidents when they occur. School violence and crime are often the product of a complex, multicausal problem (Henry, 2009) that requires approaching school safety and security with an interdisciplinary lens. Systems thinking makes this possible.

In summary, we highlight three major takeaways from our systems approach to school physical security:

- At a high level, a systems approach requires conceptualizing school physical security as a component within the broader school safety system, which also includes the elements of prevention and response and recovery. Measures put in place to protect and mitigate risk extend beyond the physical security space to affect and interact with important elements of school violence prevention, such as student mental health and school climate, and emergency response and recovery efforts.
- School physical security is itself a system consisting of five core elements:
  - physical security equipment and technology
  - building and architectural design features
  - people and personnel
  - policies and procedures
  - associated training and exercise requirements.
- The equipment, technology, and design features that a school has in place to protect its campus are all interrelated within the physical security space and have cost and other implications that LEAs will need to consider. Perhaps most importantly, the people and personnel that schools have to provide security, as well as related policies, procedures, and training, ensure that these interconnected technologies, equipment, and site and building design features work in concert and in the service of the larger system.
- Finally, our systems approach stresses that an LEA will be best placed to achieve security and safety benefits when it takes a layered approach to protection and mitigation. Measures in place at various layers across a school campus—specifically, at the campus-perimeter, school-grounds, building-perimeter, and building-interior layers—provide incremental protection against threats and prevent single points of failure. The extent to which schools will need to prioritize various layers over others will depend on their unique contexts, which can include the surrounding neighborhood, campus and building layout, student population, and geographical location.

Taking such a systems approach to school physical security yields several implications for LEAs:

- First, LEAs should ensure that they are approaching physical security in a way that addresses their unique needs. There is no one-size-fits-all approach to security and safety, and thorough threat, risk, and vulnerability assessments should inform the specifics of a school's physical security design. Specifically, such factors as locale, age of the student population, local data on crime and violence, and existing security equipment and building design features should all guide and inform the design phase.
- Second, LEAs should plan to protect their campuses knowing that investments in equipment, technologies, and building design will not yield improved security outcomes in the absence of clearly defined personnel roles and responsibilities; clear, consistent, and well-communicated policies and procedures around security; and developmentally appropriate and regular training, drills, and exercises that allow the school community to practice responding to emergencies. The system's elements must work together to create security benefits, and LEAs should keep in mind that investments in one area, such as equipment, will create dependencies that flow into others—such as policies and procedures.
- Third, interventions, policies, and practices that aim to reduce school crime and violence and protect against risks should operate at multiple levels and incorporate individual students, schools, families, neighborhoods, and other community partners. An SRO is well placed to educate students about drug and alcohol safety and can help foster trust between a school's student population and law enforcement officers. Having local emergency responders participate in training and drills

for emergencies can help to improve response, insofar as these events improve emergency responders' situational awareness of school-specific emergency procedures and provide opportunities for LEAs to work with the EMS community to improve emergency operations plans.
- Finally, LEAs should think about how their approach to protection and mitigation influences and interacts with the broader educational mission, either facilitating or hindering teaching and learning. Anticipating and mitigating against unintended consequences of measures is an important step in the physical security planning process. In this sense, an LEA that already has physical security measures in place or is contemplating implementing them might consider how it can engage the broader school community to implement and use the various measures in a do-no-harm manner. It might also consider complementing visible measures with clear, fair, and supportive discipline policies, as well as efforts to keep youths academically engaged and challenged, so as to lessen and preferably eliminate the chance that certain measures might degrade school culture and climate.

Ultimately, the LEA that effectively balances the need for effective safety and security with the need to maintain a healthy school climate will ward off safety-related incidents while continuing to promote a productive and inclusive learning environment.

Appendix. Data and Analytic Approach

This appendix provides additional detail on the literature review methods used to complete both reports—this one and *Challenges in Implementing Physical Security Measures in K–12 Schools* (Steiner et al., 2021). We also highlight research limitations.

Our Literature Review

In the summer of 2020, we completed a comprehensive review of scholarly and other literature in the physical security space. To identify sources, we conducted internet searches to capture current federal, state, local, and nongovernmental guidance for school security measures and assessment resources as they pertained to school safety. We also conducted searches of the research literature focused on the use of technology and physical security measures to keep schools safe. We performed searches using Google Scholar and reviewed references from highly relevant papers. Our search terms included the following:

- *school building safety*
- *school building security*
- *school safety*
- *school security*
- *school facility safety*
- *school facility security*
- *school building design security*
- *school building design safety.*

We restricted results to K–12 school settings and excluded documents from prior to 2000.

Our literature review also targeted literature from other, nonschool sectors. We identified relevant and comparable nonschool sectors based on their similarities to school settings in certain features, such as the need to maintain a welcoming and open environment; the need to accommodate large numbers of people of diverse ages and accessibility requirements; and the individual uniqueness of facilities as a result of size, location, and other factors. Our review considered literature pertaining to physical security and safety in houses of worship; health care facilities; nonmilitary federal facilities; military facilities; critical infrastructure; correctional facilities; and crowded places, including shopping centers, event spaces, and public transportation facilities.

The documents we reviewed came from disparate sources, including peer-reviewed research, policy and issue-specific briefs, white papers and position papers, opinions from key stakeholders in the research and practitioner communities, commission reports, and course modules and instruction manuals. Topically, our review focused on physical security measures related to controlling access, surveillance equipment, barriers to entry (e.g., fences, door locks), communications, building design, and security personnel. We included documents that addressed

adjacent topics, such as school climate, when they intersected with physical security measures. Our review focused on literature addressing the effectiveness of various physical security measures, as well as literature on the effects that security and resilience measures can have on the broader educational mission and school climate.

Our searches netted 308 documents, 235 of which were school-specific and 73 of which focused on other sectors. We reviewed each document for relevance and coded each one as highly relevant (1), moderately relevant (2), or not relevant (3). Two hundred and nineteen documents were highly or moderately relevant, and we thus included these in our analysis. The analysis of challenges in implementing school physical security draws primarily on school-specific literature but also includes relevant examples from non–school-specific literature. Table A.1 summarizes the characteristics of the documents collected.

Small-Group Stakeholder Discussions

We conducted two small-group discussions with school security experts and practitioners in the fall of 2020. These discussions were part of a larger initial planning conference hosted by CISA in October 2020. The purpose of the conference was to introduce the agency's initiative to produce a new generation of guidance on school safety and security, and the small-group discussions were organized to take advantage of the collection of experts gathered for this conference, in the hopes that they would provide us with a small amount of additional, qualitative information to ensure that our literature review covered key challenges as perceived by school security experts.

These discussions included a total of 11 school safety experts from the two discussion groups. Participants included LEA emergency managers, former principals, state leaders of safe-school initiatives, and national school safety and security organization leaders. Each discussion, moderated by a RAND researcher, lasted one hour. The protocol was semistructured to provide consistency in questions asked and to allow participants to elaborate on their responses and offer unsolicited input. The following questions guided the discussions:

1. What does taking a systems approach to school safety mean to you? What guidance would you give school or district staff about how to take a systems approach in their contexts?
2. What school or student characteristics, or aspects of the school schedule, should inform national guidance for improving physical school security?
3. In your specific context, what are the key facilitators and barriers to implementing physical security measures to improve school safety?

Members of the study team took notes during the stakeholder discussion groups, conducted a thematic analysis of the notes, and discussed findings among themselves.

Research Limitations

Although the literature review and policy analysis were comprehensive, they might not have been exhaustive. In addition to compiling sources based on our Google Scholar and other internet searches, we scanned the reference lists of the most-relevant papers and reviewed relevant resources that had not already been captured in our literature review. Nevertheless, it remains possible that we did not reach saturation. Although our review process included consulting sources from outside the school sector, we consulted only a limited number of these, so it is possible that our review did not capture all relevant discussions. Moreover, the small-group stakeholder discussions were opportunistic, and the data are limited by their self-reported nature, convenience sampling approach, and small samples. They might therefore represent only a limited set of experiences and opinions among the broader practitioner community.

Despite these limitations, we believe that these reports demonstrate best practices in implementing systems approaches to physical security and increase awareness of the constraints under which LEAs operate when planning for their physical security needs and selecting appropriate measures.

TABLE A.1

Summary of Documents Collected in the Literature Review

Characteristic	School Specific	Non–School Specific	Row Total	Category Total
Relevance				
1 (highly relevant)	66	25	91	
2 (moderately relevant)	113	15	128	219
3 (not relevant)	56	33	89	308
Counts below this line exclude relevance = 3 (not relevant)	235	73		
Instrument				
Yes	27	11	38	
Non–school-specific sector				
Houses of worship		3		
Transportation		23		
Health care		7		
Nonmilitary federal facilities		6		
U.S. Department of Defense facilities		2		
Other		32		
Geographic area				
National	84	34	118	
State	30	0	30	
Regional	3	0	3	
District	5	0	5	156
Document type				
Federal or national guidance	51	23	74	
State guidance	26	0	26	
District guidance	0	0	0	
Peer-reviewed study or report	57	6	63	
Report (no peer review)	25	7	32	
Case study	16	0	16	
Commission report	5	0	5	
Issue or policy brief	5	0	5	
Guidance from school safety association	10	0	10	
Webpage	14	0	14	
Legislation	3	0	3	
Doctrine	0	1	1	
Opinion	7	3	10	

Table A.1—Continued

Characteristic	School Specific	Non–School Specific	Row Total	Category Total
Course module or instruction manual	4	0	4	263
Document approach				
Vulnerability assessment	41	17	58	
Risk management	70	29	99	
Training	39	17	56	
Systems approach to physical security	67	21	88	
Other	53	4	57	
Guidance specific to school or community characteristics				
Grade level	19			
Student or visitor population	11			
Locale	5			
Other (specify)	0			35
Guidance specific to school spaces				
Inside the school building	62			
Classrooms	34			
Common spaces (e.g., cafeterias, auditoriums, hallways)	34			
Private spaces (e.g., offices, lounge, restrooms)	26			
Outside the school building	50			
Athletic facilities	14			
Modular units	8			228
Guidance specific to school activities				
Instructional time	4			
Transition time (school arrival or dismissal; between classes)	7			
Before- or after-school or weekend activities	5			16
System-level approach: considers implications of				
Cost	53	18	71	
Staff time	16	3	19	
School climate	68	1	69	
Incidents other than shootings	69	12	81	
Student or staff mental health	32	1	33	
Criminal justice system	17	0	17	
Integration of old and new	20	5	25	
Process for training	32	10	42	
Continuous improvement	20	4	24	

Table A.1—Continued

Characteristic	School Specific	Non–School Specific	Row Total	Category Total
Recommendations	40	4	44	
Planning				
Includes planning guidance	45	23		
Planning with school officials	31			
Planning with law enforcement	32	4		
Planning with other stakeholders	31	3		

NOTE: Researchers coded each document according to its relevance to the topic of school physical security. A code of 1 indicates the most-relevant documents, and a code of 3 indicates irrelevant documents. We excluded from our analysis any document coded as 3.

Notes

[1] This number includes thefts and violent victimizations, such as rape, sexual assault, robbery, and aggravated and simple assault.

[2] *Zero-tolerance policy* refers to school disciplinary measures that rely on exclusionary punishment, such as suspension and expulsion, and a discipline code that provides school administrators and teachers little discretion in individualizing responses to behavioral problems. Under a zero-tolerance regime, even low-level infractions are typically met with harsh punishment. See, e.g., Garver and Noguera, 2012.

[3] The U.S. Department of Education defines an LEA as a public board of education or other public authority that administers public schools. LEAs can consist of a single school, a single district or school system, or multiple school districts or school systems (U.S. Department of Education, undated).

[4] The 2020 National School Safety and Physical Assessment Virtual Roundtable, focus group session with school safety and security subject-matter experts, October 2020.

[5] A common approach to physical security focuses on the specific goals, or functions, of detection, delay, and response:

- *Detection* relates to those measures that alert to the presence of a person or threat as it is occurring.
- *Delay* includes those measures put in place to increase the physical resources, capabilities, and time necessary for someone to carry out a threatening action.
- *Response* refers to those measures that contribute to stopping the threat by engaging the attacker with force, capturing them, or causing them to flee. (See, e.g., Williams, 2019.)

[6] Other resources that we reviewed for this report provide similar frameworks and approaches to physical security planning in schools. See, for example, Johns Hopkins University Applied Physics Laboratory (APL), 2016.

[7] Some approaches to school physical security, such as *Safety and Security Guidelines for K–12 Schools* (Partner Alliance for Safer Schools, 2020), include an additional layer of protection at the school district level. This level is outside the scope of this report, which considers only protection and mitigation against events that are likely to occur within a school's perimeter. As a result, we do not speak to approaches addressing safety and security on school buses or bus routes, field trips, or walking or biking routes.

[8] The National School Climate Center defines *school climate* as "the quality and character of school life. School climate is based on patterns of students', parents', and school personnel's experience of school life; it also reflects norms, goals, values, interpersonal relationships, teaching and learning practices, and organizational structures" (National School Climate Center, undated).

[9] Later in this report, we provide a more complete discussion of the benefits and costs associated with hiring SROs.

[10] Examples of human-caused hazards include terrorist attacks and active-shooter incidents, unarmed physical assaults, arson or other incendiary attacks, and the intentional or accidental release of hazardous materials. Accidental human-caused hazards can also be referred to as *technological hazards* and can include such events as transport accidents, toxic-waste spills, dam failures, and factory explosions.

[11] Duval County Public Schools in Jacksonville, Florida, for example, has its own police force made up of more than 50 SROs assigned to a total of 52 schools. See Chen, 2020.

[12] As of 2019, 16 states encouraged or required schools to conduct active-shooter drills. Ohio and Indiana passed the earliest laws in 2006 and 2007, respectively (Temkin et al., 2020).

[13] Such phrases as "code red," for example, might be used to trigger a school lockdown during an active-shooter event. See, e.g., Foley, undated.

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About This Report

The Cybersecurity and Infrastructure Security Agency (CISA) asked the Homeland Security Operational Analysis Center (HSOAC) to provide enhanced tools for kindergarten-through–12th grade (K–12) schools and school systems to improve school safety. As part of this task, HSOAC analysts drafted two reports on the basis of a comprehensive literature review on school safety and security. This first report leverages the knowledge and approaches to physical security planning from a wide variety of disciplines to build a systems approach to thinking about school physical security that also accounts for the effects that security measures can have on school climate and on other important elements that affect schools' ability to achieve their broader educational mission. The second report, *Challenges to Implementing Physical Security Measures in K–12 Schools* (Steiner et al., 2021), provides an overview of federal, state, and local policy landscapes as they relate to school physical security and surveys the extent to which existing guidance and regulation, as well as other factors, constitute challenges to school physical security planning and implementation. The primary audiences for this research are school- and district-level administrators and security personnel. State, local, tribal, and territorial government and law enforcement personnel, design professionals working on school buildings and other facilities, and school-related associations and stakeholder groups might also be interested in this research.

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The Homeland Security Act of 2002 authorizes the Secretary of the Department of Homeland Security (DHS), acting through the Under Secretary for Science and Technology, to establish one or more federally funded research and development centers (FFRDCs) to provide independent analysis of homeland security issues. The RAND Corporation operates the Homeland Security Operational Analysis Center (HSOAC) as an FFRDC for DHS under contract HSHQDC-16-D-00007.

The HSOAC FFRDC provides the government with independent and objective analyses and advice in core areas important to the Department in support of policy development, decisionmaking, alternative approaches, and new ideas on issues of significance. The HSOAC FFRDC also works with and supports other federal, state, local, tribal, and public- and private-sector organizations that make up the homeland security enterprise. The HSOAC FFRDC's research is undertaken by mutual consent with DHS and is organized as a set of discrete tasks.

The information presented in this report does not necessarily reflect official DHS opinion or policy.

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