Original Research Report

The Journal of School Nursing
2023, Vol. 39(3) 219–228

DOI: 10.1177/1059840520976396
journals.sagepub.com/home/jsn
SAGE

Assault Deterrents and Educators' Risk of Physical Assault: A Case–Control Study

Denise M. Feda, PhD, MPH[1,2], Susan G. Gerberich, PhD, MSPH, BSN[1], Andrew D. Ryan, MS[1], Nancy M. Nachreiner, PhD, MPH[1,3], and Patricia M. McGovern, PhD, MPH, RN[1]

Abstract

The study purpose was to identify associations between assault deterrent presence in kindergarten through 12th (K–12) grade schools and physical assaults (PAs) against educators. Data collected through a two-phase study identified physical and nonphysical violent events and utilized a nested case–control study to identify PA risk/protective factors. Analyses included multivariable modeling. Adjusted analyses demonstrated a significant decreased risk of PA with routine locker searches (odds ratio [*OR*] = 0.49, 95% confidence interval [CI] [0.29, 0.82]). Also important, although not statistically significant, were presence of video monitors (*OR* = 0.72, 95% CI [0.50, 1.03]), intercoms (*OR* = 0.77, 95% CI [0.55, 1.06]), and required school uniforms/dress codes (*OR* = 0.74, 95% CI [0.52, 1.07]). These findings are integral to school nursing practice in which there is opportunity to influence application of relevant pilot intervention efforts as a first step in determining the potential efficacy of broad-based interventions that can positively impact the problem of school-related violence.

Keywords

occupational violence, physical assault, educators/teachers, K–12 schools, assault deterrents

Physical and nonphysical assault (PA) in the workplace is a serious concern, especially among educators in the United States. The growing literature of studies and systematic reviews (Gregory et al., 2012; McMahon et al., 2014; Moon & McCluskey, 2020; Reddy et al., 2018; Tiesman et al., 2013; Wang et al., 2020) point to the magnitude of the problem; for example, McMahon et al. (2014) found that 80% of educators experienced victimization at school within the current or last year and that 44% of educators reported physical attack within the same time period. Not only is this a problem in the United States but, also, it is a major problem internationally (Chen & Astor, 2009; Debarbieux, 2003; Dzuka & Dalbert, 2007; Kauppi & Porhola, 2012; Khoury-Kassabri et al., 2009; Lomić et al., 2013; Longobardi et al., 2019; Moon et al., 2015; Wilson et al., 2011) As colleagues, within the school environment, school nurses are in a unique position to influence and educate their schools through presentations and discussions of the magnitude and consequences of this problem (National Association of School Nurses [NASN], 2018). Importantly, nurses may also leverage their knowledge and experience to advocate for preventive measures, new policies, and best practice guidance that may reduce school-related violence.

Schools with environments at higher risk of violence may experience greater than average teacher retirements or turnovers earlier than planned (Crews et al., 2006). Assault deterrents have been provided in some school environments with the intent to prevent violent events; however, the efficacy of those deterrents on PA against educators has not been determined.

The mechanism of how different assault deterrents prevent violence can be understood following the National Institute for Occupational Safety and Health's hierarchy of controls model (Centers for Disease Control and Prevention,

[1] Regional Injury Prevention Research Center and Center for Violence Prevention and Control, Midwest Center for Occupational Health and Safety—Education and Research Center, Division of Environmental Health Sciences, School of Public Health, University of Minnesota, Minneapolis, MN, USA
[2] Epidemiology and Environmental Health, University at Buffalo, NY, USA
[3] United States (US) Customs & Border Protection (CBP) Hiring Center, Office of Human Resources Management, USA

Corresponding Author:
Susan G. Gerberich, PhD, MSPH, BSN, Regional Injury Prevention Research Center and Center for Violence Prevention and Control, Midwest Center for Occupational Health and Safety—Education and Research Center, Division of Environmental Health Sciences, School of Public Health, University of Minnesota, 420 Delaware Street, MMC 807, Minneapolis, MN 55455, USA.
Email: gerbe001@umn.edu

National Institute for Occupational Safety and Health, 2020), where assault deterrents within the school environment fall into various categories of control. For example, a security guard may directly prevent violence by removing an individual from the environment (elimination control), required school uniforms may indirectly prevent violence by eliminating wearing of disparately priced clothing or colors associated with gangs or offensive text (administrative control), and some educators may choose to carry a cell phone or personal alarm (personal protective equipment control).

Typically, in school environments, there may be several deterrents present. Data from past and recent Indicators of School Crime and Safety reports (Dinkes et al., 2009; Wang et al., 2020; Zhang et al., 2016) identified the following common assault deterrents, respectively, for 2004–2005, 2013–2014, and 2017–2018: Schools controlled access to buildings by locking and monitoring doors (84%, 93%, 95%), required faculty and staff to wear identification (ID) badges (48%,68%, 70%), required ID badges for students (6%, 9%, 9%), used security cameras to monitor school (38%, 75%, 83%), required students to wear school uniforms (14%, 20%, 20%), had telephones in the classrooms (64%, 78%, not available [NA]), and required students or visitors to pass through metal detectors daily (1%, 2%, daily NA). Wang et al. (2020) provided a comparative, historical perspective, as well, using data from 1999 to 2018, reporting that controlled access to buildings, security camera usage, ID badge usage for staff and students, and required uniforms all increased in prevalence over time, whereas random metal detector usage decreased. Data from the national sources, as well as an occupational violence study by Gerberich et al. (2005), served as a basis for determining which assault deterrents to include in the current study.

While the prevalence of assault deterrents at the national level has been examined (Zhang et al., 2016), the efficacy of the deterrents has not. Studies specific to efficacy of assault deterrents in schools are limited both in number and methods used (Casteel et al., 2007). When 22 Midwestern high school teachers were asked about locations of violence occurrence and perceptions of the efficacy of assault deterrents such as metal detectors, security guards, and surveillance systems on student–student violence, most teachers believed security systems were only as effective as the security personnel monitoring the systems (Astor et al., 2005). Furthermore, teachers believed security guards to be ineffective because of high turnover rates, low salaries, and lack of caring (Astor et al., 2005). However, their administrators perceived the opposite—that security guards were highly effective (Astor et al., 2005). These findings were similar to Kingery and Coggeshall (2001) who observed that the supervision required for security systems was not always available and that the systems are expensive to install and operate.

Some studies have examined specific assault deterrents in school environments for their impact on school crime and school climate. For example, teachers from schools with uniform policies, versus none, perceived lower levels of gang presence; however, more comprehensive research was advised (Wade & Stafford, 2003). Using a national cross-sectional study subsample, Mayer and Leone (1999) studied six assault deterrents (three personnel-based and three physical-based) and their impact on school disorder—a construct defined by three variables: presence of drugs, presence of gangs, and personal attack and theft. Results suggested that as the number of personnel-based and physical-based deterrents increased, so did school disorder and disruption; such results may relate to the study design (e.g., cross-sectional vs. case-control) that did not allow for adequate examination of the relations between exposures and outcome. Further, from a survey of 215 Texas school principals, investigating potential effects of security measures on school crime in middle and high schools, it was reported that metal detectors were correlated with increased levels of interpersonal crime (Cheurprakobkit & Bartsch, 2005); again, this finding was based on a cross-sectional study. Despite previous contributions to the knowledge base, there have been no specific analytical studies on assault deterrents and their impact on physical violence against educators.

The objectives of this study were to (1) determine the prevalence of specific assault deterrents in schools in an upper Midwestern U.S. state and (2) determine the relation between the presence of assault deterrents and work-related PA against educators. It was hypothesized that the presence of the assault deterrents considered would decrease educators' risk of assault.

Materials and Methods

Study Design

The Minnesota educators' study (Gerberich et al., 2008, 2011a, 2011b, 2014) involved two phases: (1) a comprehensive phase to collect data on the magnitude and consequences of, and potential risk factors for, physical and nonphysical violence and (2) a nested case-control design (http://www.strobe-statement.org) to identify risk or protective factors for PA; the second phase data collection is the primary focus of the current study. Approvals for the main study, and for the analyses of this effort, were obtained from the University of Minnesota Institutional Review Board.

Definitions

Violence is the intentional use of physical force or emotional abuse against an individual resulting in physical or emotional injury and consequences. In this article, only student-perpetrated PA was addressed: "PA occurs when one is hit, slapped, kicked, pushed, choked, grabbed, sexually assaulted, or otherwise subjected to physical contact intended to injure or harm" (Gerberich et al., 2004, 2005). Violence is work-related if it occurs during any activities in

the work environment or is associated with the job (including travel). These definitions, primarily consistent with those incorporated in a prior occupational violence study (Gerberich et al., 2004, 2005), reflect those identified by the National Institute for Occupational Safety and Health (U.S. Department of Health and Human Services, National Institute for Occupational Safety and Health, 1996) and were approved for this study in consultation with the educational advisory consulting team involving teachers and administrators who participated in study development, instrument review, and results discussions. If a respondent reported at least one work-related PA event during the previous 12 months on the comprehensive Phase I survey, they were considered a "case" ($N = 372$); if cases reported more than one assault, the most remote event was used. This decreased the probability that intervening PA events would influence the exposures that cases reported. If no PA events were reported on the Phase I survey, respondents were eligible to be selected as a "control."

Participants

The study pkopulation was selected from the Minnesota Department of Education's database of licensed kindergarten—12th (K–12) grade educators. This database included the following information: education level, gender, date of birth, license type, and home address for all educators licensed to teach in schools in the state. Results from a pilot study ($N = 300$) indicated that "lifetime license" holders should be excluded from the study, as the majority of these individuals were either deceased or not working as licensed educators. Also excluded were individuals who had licenses that expired prior to 2003. From the target population of 116,661 licensed Minnesota educators, 26,000 were randomly selected and were sent an eligibility screening survey. Eligibility for the study required the educator to have worked as a licensed educator in a K–12 school in the state within the months of June 2004 through December 2005. A total of 8,614 educators responded to this screening survey, and 6,469 were determined as eligible to receive the Phase I, comprehensive survey. The response rate for Phase I was 84%. From this Phase I survey, 372 cases and 1,116 controls were identified (1:3, case–control ratio) and were mailed the Phase II specially designed case-control questionnaire; the Phase II response rate was also 84%. Only cases perpetrated by students were used in this analysis ($N = 290$, 97% of cases).

Data Collection

All data collection for this study was conducted through mailed surveys (Center for Violence Prevention and Control, 2017; Gerberich et al., 2008); up to four mailings were used to optimize response rates. The comprehensive Phase I questionnaire enabled data collection of demographic information, general school information, professional activity information, and physical and nonphysical violent events experienced within the past 12 months. The Phase II case-control survey enabled collection of information on potential exposures that could have influenced risk of work-related PA during a specific time period in which they worked; cases were asked to recall information from the calendar month before the assault month, while controls were asked to recall from a randomly selected month in which they had worked. Included in the case-control survey were questions about the presence of specific assault deterrents in the work environment such as video monitor, metal detection device, security alarm/panic button/emergency call-in system, controlled access to work area or classroom, personal portable alarm, cellular telephone, two-way radio/walkie-talkie, intercom, classroom telephone, required visible identification badges, on-site security personnel (noneducator), contracted police presence, school resource officer, escort/bodyguard, routine locker searches, school uniform/dress code, and administrative surveillance of computer usage by staff and students.

Statistical Analysis

The purpose of this analysis was to (1) determine the incidence of assault deterrents in Minnesota schools and (2) determine the association between the presence of assault deterrents in the educators' work environments and work-related PA. In addition to descriptive analysis, individual multivariable logistic regression models were created for each exposure of interest, that is, assault deterrents, in relation to PA. To determine potential confounders for each model, directed acyclic graphs (DAGs) were developed (Greenland et al., 1999; Hernán et al., 2002). Covariates for the analyses were selected by mapping out each assault deterrent's hypothesized association between the assault deterrent, potential confounders, and work-related PA. The goal of the analyses was to estimate the effect of specific exposures of interest on work-related PA, while controlling for important confounding factors. For each exposure of interest, confounders were selected a priori for multivariable logistic regression, using the counterfactual principles in Maldonado and Greenland (2002) and based on DAGs (Greenland et al., 1999; Hernán et al., 2002). The assumption behind the regressions is that adjustment for confounders can create a valid counterfactual substitute (Maldonado & Greenland, 2002) for comparison of exposed with unexposed members of the target population. A master DAG was created for the outcome of interest (Supplemental Figure 1); then for each exposure of interest, the DAG was reduced to the relevant pathways to identify a minimal set of confounders to be included in the respective multivariable regression analyses (Maldonado & Greenland, 2002; refer to Supplemental Figure 2 for an example of one exposure of interest). This method identifies parsimonious models and excludes

covariates that should not be entered into the regression lest they introduce bias (Hernán et al., 2002).

The presence of personal assault deterrents may depend on the preference of the educator, whereas environmental assault deterrents are fixed in the environment. Therefore, assault deterrents of a more personal nature (e.g., cellular telephone) and environmental assault deterrents (e.g., intercom) were hypothesized to have slightly different sets of potential confounders in the relations between the assault deterrents and the outcome of interest—work-related PA.

The analyses also included collapsing of response categories for some variables and re-weighting of the regression models. Assault deterrents, originally stratified into more than one "yes" category response (e.g., video monitors with directions to "check all that apply," regarding locations of the monitors), were collapsed into a single "yes" category to increase power. Multivariable logistic regression estimates were re-weighted to account for potential bias from nonresponse and from unknown eligibility of nonresponders by using data from the licensing database (Efron &Tibshirani, 1993; Mongin, 2001); variables used in this re-weighting included year of birth, fiscal year data, zip code, principal and teacher years, salary, teaching time, and grade level(s) taught.

For all models, the risk of PA was estimated through odds ratios (*OR*s) and 95% confidence intervals (CIs). The *OR* can be interpreted as the risk of PA related to each specific assault deterrent (exposure of interest).

Results

The adjusted rate of PA was 8.3 per 100 educators (nonadjusted rate, 7.9), based on incurring at least one event, despite the fact that some educators experienced multiple events. These analyses were limited to student-perpetrated PA against educators ($N = 290$, 97% of all cases).

Selected characteristics of the educators, their schools and their students, for both cases and controls, are identified in Table 1. The majority of participants were Caucasian (98%). Both cases and controls were primarily female and similar in age. Cases and controls also had similar work histories on average; cases and controls had worked as licensed educators for 15 and 17 years, respectively. Comparisons relevant to school type, location and enrollment, as well as student age and gender identified some variations between cases and controls. Additional descriptive statistics are published elsewhere (Gerberich et al., 2011a, 2011b).

The reported proportions of cases and controls, indicating the presence of assault deterrents in their schools, are presented in Table 2. Cases and controls both reported a limited presence of metal detection devices, escorts/bodyguards, and personal protective alarms in their environment. However, both reported similar moderate to large presences of security personnel, use of cell phones, and school resource officers. Controls were more likely than cases to report the presence of video monitors (63% vs. 48%) and routine locker searches (17% vs. 11%).

Supplemental Table 3 identifies the results of the multivariable weighted regression analyses. A separate model,

Table 1. Characteristics of the Educators, Educators' Schools, and Educators' Students by Case-Control Status: Violence Against Educators' Study.

Educator, School, and Student Characteristics	Cases		Controls	
	$N = 290$	%	$N = 867$	%
Educator age				
<25	2	0.7	7	0.8
≥25 to <35	59	20.3	138	15.9
≥35 to <45	63	21.7	217	25.0
≥45 to <55	107	36.9	305	35.2
≥55	59	20.3	200	23.1
Educator gender				
Male	55	19	197	23
Female	235	81	670	77
Missing (refused)	0 (0)	0 (0)	0 (0)	0 (0)
School type				
Public	253	87	713	82
Public alternative	14	5	30	3
Public charter	8	3	17	2
Public magnet	7	2	5	1
Private (parochial)	3	1	78	9
Private (nonparochial)	1	0.3	15	2
Missing (refused)	4 (0)	1 (0)	9 (0)	1 (0)
School location				
Rural	91	31	327	37
Urban	90	31	183	21
Suburban	105	36	348	40
Missing (refused)	4 (0)	1 (0)	9 (0)	1 (0)
School enrollment				
Less than 50 students	12	4	16	2
50–200 students	33	12	100	12
201–500 students	106	37	269	32
501–1,000 students	99	35	290	34
More than 1,000 students	36	13	183	21
Missing (refused)	4 (0)	1 (0)	9 (0)	1 (0)
Student age-group in teacher's classroom [a]				
Less than age 5	1	0.3	4	0.5
5 to <10 years	90	31	222	26
10 to <13 years	34	12	140	16
13 to <16 years	33	11	124	14
16 to <18 years	23	8	112	13
18 years or older	3	1	6	0.7
Mixed age groups	17	6	41	5
Missing (refused)	5 (0)	2 (0)	7 (0)	<1 (0)
Student gender in teacher's classroom [a]				
Primarily male	82	28	112	13
Primarily female	5	2	34	4
Appeared equal	113	39	501	58
Missing (refused)	5 (0)	2 (0)	6 (0)	<1 (0)

[a] Self-identified classroom teachers, only, were instructed to respond to the student demographic questions.

Table 2. Frequencies of the Presence of Assault Deterrents by Case-Control Status: Violence Against Educators' Study.

	Cases		Controls	
Assault Deterrents	$N = 290$	%	$N = 867$	%
Video monitor				
At school entrance	67	23	268	31
In classrooms	5	2	19	2
In hallways	66	23	256	30
No	176	61	442	51
Unsure	12	4	42	5
Missing (refused)	7 (0)	2 (0)	21 (1)	2 (0.1)
Metal detection device				
Yes	6	2	1	0.1
No	270	93	829	96
Unsure	7	2	15	2
Missing (refused)	7 (0)	2 (0)	21 (1)	2 (0.1)
Security alarm/panic button/emergency call-in system				
Yes	75	26	239	28
No	201	70	537	62
Unsure	7	2	67	8
Missing (refused)	7 (0)	2 (0)	23 (1)	3 (0.1)
Controlled access to work area or classroom				
Yes	114	39	333	38
No	158	54	454	52
Unsure	10	3	57	7
Missing (refused)	8 (0)	3 (0)	22 (1)	3 (0.1)
Personal portable alarm				
Provided by educator	17	6	40	5
Provided by employer	10	3	16	2
Provided by another institution/person	3	1	1	0.1
Not available	237	82	724	84
Unsure	19	7	64	7
Cellular telephone				
Provided by educator	139	48	386	45
Provided by employer	8	3	25	3
Provided by another institution/person	1	0.3	2	0.2
Not available	131	45	416	48
Unsure	6	2	20	2
Missing (refused)	7 (0)	2 (0)	21 (1)	2 (0.1)
Two-way radio/walkie-talkie				
Yes	128	44	282	33
No	149	51	533	61
Unsure	6	2	29	3
Missing (refused)	7 (0)	2 (0)	22 (1)	3 (0.1)
Intercom				
Yes	134	46	252	52
No	147	51	382	44
Unsure	2	0.7	11	1
Missing (refused)	7 (0)	2 (0)	21 (1)	2 (0.1)
Classroom telephone				
Yes	266	92	770	89
No	16	6	72	8
Unsure	1	0.3	3	0.4
Missing (refused)	7 (0)	2 (0)	21 (1)	2 (0.1)
Required ID badges				
For staff	238	82	660	76
For students	16	6	35	4
Not available	39	13	174	20
Unsure	3	1	10	1
Missing (refused)	8 (0)	3 (0)	21 (1)	2 (0.1)
On-site security personnel				
Provided by employer	58	20	188	22
Provided by another institution/person	13	4	55	6
Not available	207	71	584	67
Unsure	8	3	27	3
Missing (refused)	7 (0)	2 (0)	23 (1)	3 (0.1)
Contracted police presence				
Yes	63	22	238	27
No	211	73	583	67
Unsure	9	3	24	3
Missing (refused)	7 (0)	2 (0)	21 (1)	2 (0.1)
School resource officer				
Yes	135	47	407	47
No	132	46	345	40
Unsure	16	6	93	11
Missing (refused)	7 (0)	2 (0)	21 (1)	2 (0.1)
Escort/bodyguard				
Provided by educator	4	1	6	1
Provided by employer	3	1	21	2
Provided by another institution/person	3	1	3	0.4
Not available	257	89	768	89
Unsure	17	6	48	6
Missing (refused)	7 (0)	2 (0)	21 (2)	2 (0.2)
Routine locker searches				
Yes	31	11	144	17
No	224	77	596	69
Unsure	27	9	102	12
Missing (refused)	8 (0)	3 (0)	24 (1)	3 (0.1)
School uniform/dress code policy				
Yes, uniforms were required	10	3	57	7
Yes, a formal dress code existed	11	4	47	5
Yes, an informal dress code existed	175	60	528	61
No policies on dress code	84	29	198	23
Unsure	3	1	14	2
Missing (refused)	7 (0)	2 (0)	22 (1)	3 (0.1)
Administrative surveillance of computer usage				
Yes	126	43	400	46
No	67	23	237	27
Unsure	89	31	206	24
Missing (refused)	8 (0)	3 (0)	23 (1)	3 (0.1)

that included potential confounders, was established a priori for each assault deterrent (exposure of interest). Also, each multivariable model was further adjusted for nonresponse and unknown eligibility.

Decreased risk of PA was associated with routine locker searches ($OR = 0.49$, 95% CI = [0.29, 0.82]). While the *OR*

for metal detection devices was increased, it was not statistically important and included an extremely wide CI. Finally, although not statistically important, additional potentially associated decreased risks are suggested as important by the presence of video monitors ($OR = 0.72$, 95% CI = [0.50, 1.03]), intercoms ($OR = 0.77$, 95% CI = [0.55, 1.06]), and required school uniforms or dress codes ($OR = 0.74$, 95% CI = [0.52, 1.07]). Although many educators indicated having more than one assault deterrent present in their work environment, extensive analysis (not shown) to examine different combinations of deterrents did not demonstrate any important results.

Discussion

When compared to the national data, it appeared that the presence of controlled access, required student identifications, and video cameras in Minnesota schools, as reported by the educators, were similar for the comparable time period, nationally (Zhang et al., 2016). However, in contrast to the national data, Minnesota educators reported a higher percentage of required faculty/staff ID badge use and classroom telephones but a lower percentage of required school uniforms/dress codes. While such assault deterrents have been studied previously in school environments, including their impact on environmental climate, student achievement, school disorder, and violence (Astor et al., 2005; Baker, 1998; Cheurprakobkit & Bartsch, 2005; Mayer & Leone, 1999; Welsh, 2000), the impact of specific assault deterrents on educators' risk of PA had not been explored prior to this study.

Results of the adjusted multivariable analysis suggested that having routine locker searches might reduce the educators' associated risk of PA by 51%. The presence of video monitors, intercoms, and required school uniform or dress codes also showed the potential to decrease risks by 28%, 23%, and 26%, respectively, although the results were not statistically significant. Similar to the results of a correlational study by Cheurprakobkit and Bartsch (2005), the presence of metal detectors in educators' work environments suggested a potentially associated increase in risk of PA; however, given the low frequency of exposure and wide CI, great caution is used in interpretation as limited data, unmeasured confounders of the educator or the environment (e.g., existing high-risk environment), and information and selection biases could have affected this result.

Within school populations, Mayer and Leone (1999) examined environmental controls such as hall monitors, security guards, metal detectors, locked doors, and locker checks. Their results suggested that as more physical- and personal-based types of security were present, more school disruption and disorder were observed. Other school climate research studies have also suggested that various assault deterrents have a negative impact on the school environment and are, potentially, conducive to facilitation of violence (Baker, 1998; Skiba & Peterson, 2000; Welsh, 2000). These studies lend support to the current study regarding the potentially associated increased risk of PA found with metal detectors, which may, in fact, have been introduced into existing high-risk environments. Decisions regarding implementation of new assault deterrents need to first consider the history of and overall school environmental climate.

Astor et al. (2005) reported that educators' opinions of security guards and video monitors were unsupportive in terms of their effect on school safety. While the effect of video monitors was suggestive as potentially important in this study, there is consistency in the current study findings that presence of on-site security personnel, school resource officers, and contracted police presence had no apparent effect on PA against educators.

Results from the current study also extend previous work on school uniforms and school crime. School uniforms and dress code policies are often implemented to curb student violence and are thought to play an important role in building school morale or improving school climate (Modzeleski, 1996; Stanley, 1996). In one study of school uniforms, teachers from public schools with a uniform policy perceived their school to have less gang presence and more positive school climate (Wade & Stafford, 2003). Although not statistically important, given the modest sample size of the population and self-reported data, the associated decreased risk, identified in the current study, warrants further investigation.

When comparing the results of the current study to other occupational violence studies, it appears that assault deterrents may function differently depending on the populations and associated environments. In another major occupational case–control study of violence against nurses, Gerberich et al. (2005) found that the risk of violence doubled when there was environmental lighting "less bright" than "bright as daylight." Security personnel, video monitors, and cellular telephones, provided by the employer, had little effect on the risk of physical violence. However, cellular telephones and portable alarms, provided by the nurses, themselves, were associated with decreased risks of PA against nurses (Gerberich et al., 2005). From an earlier study of occupational PA, Lee et al. (1999) found decreased rates of PA when security personnel and video monitors were present but no important effect with the presence of building alarm systems. It will be important for future research to address differences in the effects of assault deterrents in varying populations or environments. While most educators indicated having more than one assault deterrent present in their work environment, there was no evidence from analyses that different combinations of types of deterrents were important.

Strengths and Limitations

Several strategies were used to reduce potential bias in the study. Reporting errors were minimized with as many as

four follow-up contacts to optimize response rates and/or to clarify responses and by utilizing a 1-month recall period for exposures. Confounding variables were identified, a priori, using DAGs (Greenland et al., 1999; Hernán et al., 2002; Maldonado & Greenland, 2002). In addition, statistical methods, such as those used by Mongin (2001), were used in conjunction with variables from the original state Department of Education licensing database to adjust for potential nonresponse and eligibility bias; the direction and magnitude of these adjusted models were only minimally changed. However, the fact that the majority of participants were Caucasian, consistent with current state statistics, limits generalizability to some areas, nationally.

A small proportion of individuals elected not to participate thus introducing potential selection bias. These individuals may have experienced increased work-related violence compared to those who participated in the study. The self-reported data could potentially have introduced recall bias if cases recalled exposures more accurately than controls. However, to minimize the potential for recall bias, participants were asked to report only on events that occurred within the previous 12 months (Phase I) and case–control exposure data for the 1-month period prior to events (cases) or a random month (controls; Gerberich et al., 2002, 2004, 2005; Lee et al., 1999).

Given the moderate sample size, *OR*s for video monitors, intercoms, and school uniforms/dress codes were noted as potentially important findings even though the CIs slightly surpassed one. Dismissing this finding would negate the overall objective of the study to find potential protective factors against PA in educators' environments. Given the uniqueness of the study design and objective, and lack of comparable studies, the resulting data provide a contribution to the literature that serve as a basis for future efforts. Because the *OR*s suggest the possibility that assault deterrents, which are used in many schools currently, may be protective, future research needs to build upon these findings and examine such deterrents within more controlled environments.

Implications for School Nursing

The study findings are especially integral to school nurses for whom there is an opportunity to influence the application of relevant pilot interventions in order to determine the potential efficacy of broad-based interventions that can positively impact the problem of school-related violence in their respective environments. The current study analyses focused on the potential effect of the use of various types of deterrents on student-perpetrated PA against educators. However, it is important to understand the overall environmental context of exposures that can affect students, educators, and other school personnel. In a previous publication, Gerberich et al. (2014) reported that increasing risks of PA were associated with increases in the number of times educators reported witnessing students involved in PAs, threats, sexual harassment, verbal abuse, and bullying during the 1-month exposure period. For number of times educators witnessed students involved in PA, multivariable analysis identified respective *OR*s and 95% confidence limits as never (referent, 1); one to three times, 2.93 (1.95–4.41); four to 10 times, 6.95 (3.96–12.18); and 10+ times, 15.00 (7.57–29.71). Consideration for rigorous testing of the effectiveness of relevant assault deterrents in specific school environments will be important to realistic identification of the associated efficacy of such deterrents. The position of the NASN (2018) is that registered professional school nurses advance and encourage safe school environments by promoting the prevention and reduction of school violence. By virtue of their positions, school nurses have the status and opportunity to establish relevant teams and resources that can facilitate implementation of initial violence prevention efforts and positively affect the overall school environment.

Conclusions

This study estimated the presence of assault deterrents in Minnesota schools during specific time periods (just prior to the month of assault for cases and randomly selected months for controls) and examined their potential impact on educators' risk of PA. Results of the analyses indicated that the use of routine locker searches decreases the risk of PA. In addition, results suggested that the presence of video monitors, intercoms, and required school uniforms, while not statistically significant, were important and may have a potential to reduce risk of PA. Further research will be necessary to examine the mechanisms of assault deterrents in reducing risk and to further understand why and how assault deterrents may work differently at different school levels and in various geographical areas, populations, and work environments.

Authors' Note

The contents of this effort are solely the responsibility of the authors and do not necessarily represent the official view of the Centers for Disease Control and Prevention or other associated entities.

Acknowledgments

The authors thank the Advisory Consulting Team (Willarene Beasley, Charles Goodwin, Donald Hilts, Laura R. Langhoff, and Joseph P. Miller, representing supervisory and educational levels in K-12 schools) and participating educators for their commitment and important contributions to this study.

Author Contributions

Denise M. Feda and Susan G. Gerberich contributed to conception, design, acquisition, analysis, and interpretation; drafted the manuscript; critically revised the manuscript; gave final approval; and agreed to be accountable for all aspects of work ensuring integrity and accuracy. Andrew D. Ryan, Nancy M. Nachreiner, and Patricia

M. McGovern contributed to conception, design, acquisition, analysis, and interpretation; critically revised the manuscript; gave final approval; and agreed to be accountable for all aspects of work ensuring integrity and accuracy.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: Support for this research was provided, in part, by the: National Institute for Occupational Safety and Health (NIOSH), Centers for Disease Control and Prevention, Department of Health and Human Services (R01 OH007816); Midwest Center for Occupational Health and Safety - Education and Research Center (NIOSH Training Grant Number T42 OH008434); Center for Violence Prevention and Control, University of Minnesota; and Regional Injury Prevention Research Center, University of Minnesota.The contents of this effort are solely the responsibility of the authors and do not necessarily represent the official view of the Centers for Disease Control and Prevention or other associated entities.

ORCID iD

Susan G. Gerberich, PhD, MSPH, BSN https://orcid.org/0000-0001-6424-7131

Supplemental Material

The supplemental material for this article is available online.

References

Astor, R. V., Meyer, H. A., & Behre, W. J. (2005). Unowned places and times: Maps and interviews about violence in high schools. *American Educational Research Journal*, *36*(1), 3–42. https://doi.org/10.3102/00028312036001003

Baker, J. A. (1998). Are we missing the forest for the trees? Considering the social context of school violence. *Journal of School Psychology*, *36*(1), 29–44. http://doi.org/10.1016/S0022-4405(97)00048-4

Casteel, C., Peek-Asa, C., & Limbos, M. A. (2007). Predictors of nonfatal assault injury to public school teachers in Los Angeles City. *American Journal of Industrial Medicine*, *50*(12), 932–939. http://doi.org/10.1002/ajim.20520

Center for Violence Prevention and Control, University of Minnesota. (2017). Retrieved July 25, 2020, from http://cvpc.umn.edu/research.html

Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health. (2020). *Hierarchy of controls*. Retrieved January 13, 2015, from https://www.cdc.gov/niosh/topics/hierarchy/default.html

Chen, J.-K., & Astor, R. A. (2009). Students' reports of violence against teachers in Taiwanese schools. *Journal of School Violence*, *8*, 2e17. http://doi.org/10.1080/15388220802067680

Cheurprakobkit, S., & Bartsch, R. A. (2005). Security measures on school crime in Texas middle and high schools. *Education Research*, *47*(2), 235–250. https://doi.org/10.1080/00131880500104366

Crews, K., Crews, J., & Turner, F. (2006). School violence is not going away so proactive steps are needed. *Education Today*, *6*, 23–25. http://doi.org/10.19030/ctms.v4i1.5045

Debarbieux, E. (2003). School violence and globalization. *Journal of Educational Administration*, *41*(6), 582e602. http://doi.org/10.1108/09578230310504607

Dinkes, R., Kemp, J., & Baum, K. (2009). *Indicators of school crime and safety: 2009* (NCES 2010–012/NCJ 228478). National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education, and Bureau of Justice Statistics, Office of Justice Programs, U.S. Department of Justice.

Dzuka, J., & Dalbert, C. (2007). Student violence against teachers: Teachers' well-being and the belief in a just world. *European Journal of Psychology*, *12*, 253e60. http://doi.org/10.1027/1016-9040.12.4.253

Efron, B., & Tibshirani, R. (1993). *An introduction to the bootstrap*. Chapman & Hall.

Gerberich, S. G., Church, T. R., McGovern, P. M., Hansen, H. E., Nachreiner, N. M., Geisser, M. S., Ryan, A. D., Mongin, S. J., & Watt, G. D. (2004). An epidemiological study of the magnitude and consequences of work related violence: The Minnesota nurses' study. *Occupational and Environmental Medicine*, *61*(6), 495–503. http://doi.org/10.1136/oem.2003.007294

Gerberich, S., Church, T. R., McGovern, P. M., Hansen, H. E., Nachreiner, N. M., Geisser, M. S., Ryan, A. D., Mongin, S. J., Watt, G. D., & Jurek, A. (2005). Risk factors for work-related assaults on nurses. *Epidemiology*, *16*(5), 704–709. http://doi.org/10.1097/01.ede.0000164556.14509.a3

Gerberich, S. G., Church, T. R., McGovern, P. M., Hansen, H. E., Nachreiner, N. M., Geisser, M. S., Watt, G. D., Ryan, A. D., Mongin, S. J., & Jurek, A. (2002). *A study of risk factors for violence among nurses* (R01 OH03438). Final performance report to the sponsor, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health. University of Minnesota.

Gerberich, S., Church, T. R., McGovern, P. M., Nachreiner, N. M., Ryan, A. D., Geisser, M. S., Mongin, S. J., Watt, G. D., Feda, D., Sage, S. K., & Pinder, E. (2008). *Violence against teachers: Etiology and consequences* (R01 OH007816). *Final performance report to the sponsor, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health*. University of Minnesota.

Gerberich, S. G., Nachreiner, N. M., Ryan, A. D., Church, T. R., McGovern, P. M., Geisser, M. S., Mongin, S. J., Watt, G. D., Feda, D. M., Sage, S. K., & Pinder, E. D. (2011a). Violence against educators: A population-based study. *Journal of Occupational and Environmental Medicine*, *53*(3), 294–302. https://doi.org/10.1097/JOM.0b013e31820c3fa1

Gerberich, S. G., Nachreiner, N. M., Ryan, A. D., Church, T. R., McGovern, P. M., Geisser, M. S., Mongin, S. J, Watt, G. D.,

Feda, D. M., Sage, S. K., & Pinder, E. D. (2011b). Violence against educators: A population-based study—Erratum. *Journal of Occupational and Environmental Medicine*, *53*(5), 585. https://doi.org/10.1097/JOM.0b013e318219fd1b

Gerberich, S. G., Nachreiner, N. M., Ryan, A. D., Church, T. R., McGovern, P. M., Geisser, M. S., Mongin, S. J., Watt, G. D., Feda, D. M., Sage, S. K., & Pinder, E. D. (2014). Case-control study of student-perpetrated physical violence against educators. *Annals of Epidemiology*, *24*, 325–332. http://doi.org/10.1016/j.annepidem.2014.02.006

Greenland, S., Pearl, J., & Robins, J. M. (1999). Causal diagrams for epidemiologic research. *Epidemiology*, *10*(1), 37–48. https://doi.org/10.1097/00001648-199901000-00005

Gregory, A., Cornell, D., & Fan, X. (2012). Teacher safety and authoritative school climate in high schools. *American Journal of Education*, *118*(4), 401–425. https://doi.org/10.1086/666362

Hernán, M. A., Hernández-Díaz, S., Werler, M. M., & Mitchell, A. A. (2002). Causal knowledge as a prerequisite for confounding evaluation: An application to birth defects epidemiology. *American Journal of Epidemiology*, *155*(2), 176–184. http://doi.org/10.1093/aje/155.2.176

Kauppi, T., & Porhola, M. (2012). Teachers bullied by students: Forms of bullying and perpetrator characteristics. *Violence and Victims*, *27*(3), 396–413. https://doi.org/10.1891/0886-6708.27.3.396

Khoury-Kassabri, M., Astor, R. A., & Benbenishty, R. (2009). Middle Eastern adolescents' perpetration of school violence against peers and teachers: A cross-cultural and ecological analysis. *Journal of Interpersonal Violence*, *24*(1), 159e82. http://doi.org/10.1177/0886260508315777

Kingery, P. M., & Coggeshall, M. B. (2001). Surveillance of school violence, injury, and disciplinary actions. *Psychology in the Schools*, *38*(2), 117–126. http://doi.org/10.1002/pits.1004

Lee, S. S., Gerberich, S. G., Waller, L. A., Anderson, A., & McGovern, P. (1999). Work-related assault injuries among nurses. *Epidemiology*, *10*(6), 685–691. http://doi.org/10.1097/00001648-199911000-00007

Lomić, M., Opić, S., & Bilić, V. (2013). Violence against teachers—Rule or exception? *International Journal of Cognitive Research in Science, Engineering and Education*, *1*(2), 10.

Longobardi, C., Badenes-Ribera, L., Fabris, M. A., Martinez, A., & McMahon, S. D. (2019). Prevalence of student violence against teachers: A meta-analysis. *Psychology of Violence*, *9*(6), 596–610. https://doi.org/10.1037/vio0000202

Maldonado, G., & Greenland, S. (2002). Estimating causal effects. *International Journal of Epidemiology*, *31*(2), 422–429. http://doi.org/10.1093/ije/31.2.422

Mayer, M. J., & Leone, P. E. (1999). A structural analysis of school violence and disruption. *Education and Treatment of Children*, *22*(3), 333–356.

McMahon, S. D., Martinez, A., Espelage, D., Rose, C., Reddy, L. A., Lane, K., Anderman, E., Reynolds, C., Jones, R., & Brown, V. (2014). Violence directed against teachers: Results from a national survey. *Psychology in the Schools*, *51*(7), 753–766. https://doi.org/10.1002/pits.21777

Modzeleski, W. (1996). Creating safe schools—Roles and challenges, a federal perspective. *Education and Urban Society*, *28*(4), 412–423.

Mongin, S. J. (2001). Adjustment for non-response in the Minnesota nurses study. Division of Environmental Health Sciences, University of Minnesota, Minneapolis. Retrieved November 25, 2020, from https://www.sph.umn.edu/sph-2018/wp-content/uploads/2020/07/response.adjustment.1.pdf

Moon, B., & McCluskey, J. (2020). An exploratory study of violence and aggression against teachers in middle and high schools: Prevalence, predictors, and negative consequences. *Journal of School Violence*, *19*(2), 22–137. https://doi.org/10.1080/15388220.2018.1540010

Moon, B., Morash, M., Jang, J. O., & Jeong, S. (2015). Violence against teachers in South Korea: Negative consequences and factors leading to emotional distress. *Violence and Victims*, *30*(2), 279–292. https://doi.org/10.1891/0886-6708.vv-d-13-00184

National Association of School Nurses. (2018). *School violence—The role of the school nurse* [Position statement]. https://www.nasn.org/nasn/advocacy/professional-practice-documents/position-statements/ps-violence

Reddy, L., Espelage, D., Anderman, E., Kanrich, J., & McMahon, S. (2018). Addressing violence against educators through measurement and research. *Aggression and Violent Behavior*, *42*, 9–28. https://doi.org/10.1016/j.avb.2018.06.006

Skiba, R., & Peterson, R. L. (2000). School discipline at a crossroads: From zero tolerance to early response. *Exceptional Children*, *66*, 335–346.

Stanley, M. S. (1996). School uniforms and safety. *Education and Urban Society*, *28*(4), 424–435. http://doi.org/10.1177/0013124596028004003

Tiesman, H., Konda, S., Hendricks, S., Mercer, D., & Amandus, H. (2013). Workplace violence among Pennsylvania education workers: Differences among occupations. *Journal of Safety Research*, *44*, 65–71. https://doi.org/10.1016/j.jsr.2012.09.006

U.S. Department of Health and Human Services, National Institute for Occupational Safety and Health. (1996). Violence in the workplace: Risk Factors and prevention strategies (Current Intelligence Bulletin 57). DHHS NIOSH Publication No. 96–100. Governmental Printing Office. Retrieved July 25, 2020, from http://www.cdc.gov/niosh/docs/96-100/

Wade, K. K., & Stafford, M. E. (2003). Public school uniforms—Effect on perceptions of gang presence, school climate, and student self-perceptions. *Education and Urban Society*, *35*(4), 399–420. https://doi.org/10.1177/0013124503255002

Wang, K., Chen, Y., Zhang, J., & Oudekerk, B. (2020). *Indicators of school crime and safety: 2019*. U.S. Department of Justice, Office of Justice Programs.

Welsh, W. N. (2000). The effects of school climate on school disorder. *Annals of the American Academy of Political and Social Science*, *567*, 88–107. http://doi.org/10.1177/000271620056700107

Wilson, C. M., Douglas, K. S., & Lyon, D. R. (2011). Violence against teachers: Prevalence and consequences. *Journal of*

Interpersonal Violence, *26*(12), 2353–2371. http://doi.org/10.1177/0886260510383027

Zhang, A., Musu-Gillette, L., & Oudekerk, B. A. (2016). *Indicators of school crime and safety*: 2015 (NCES 2016-079/NCJ 249758). National Center for Education Statistics, U.S. Department of Education, and Bureau of Justice Statistics, Office of Justice Programs, U.S. Department of Justice.

Author Biographies

Denise M. Feda, PhD, MPH, is a Project Staff Associate in the Department of Epidemiology and Environmental Health, University of Buffalo, Buffalo, New York, USA.

Susan G. Gerberich, PhD, MSPH, BSN, is the Leon S. Robertson Professor in Injury Prevention and Mayo Professor of Public Health. She is the former Director in the Midwest Center for Occupational Health and Safety, Education and Research Center, Division of Environmental Health Sciences, School of Public Health, University of Minnesota, Minneapolis, MN, USA.

Andrew D. Ryan, MS, is a Senior Research Fellow in the Midwest Center for Occupational Health and Safety, Education and Research Center, Division of Environmental Health Sciences, School of Public Health, University of Minnesota, Minneapolis, MN, USA.

Nancy M. Nachreiner, PhD, MPH, is a lead nurse consultant in the Pre-employment Medical Team, Pre-employment Clearances and Sheduling Branch, Customs & Border Protection (CBP) Hiring Center, Office of Human Resources Management, US, CBP.

Patricia M. McGovern, PhD, MPH, RN, is the Bond Professor of Environmental and Occupational Health Policy and also the Deputy Director in the Midwest Center for Occupational Health and Safety, Education and Research Center, Division of Environmental Health Sciences, School of Public Health, University of Minnesota, Minneapolis, MN, USA.