**Perceptions of Active Shooter Prevention and Preparation Strategies in Pennsylvania: Links to Self-Protective Behavior**

**Abstract**

In this study, I document how members of the public perceive active shooter risk in their communities and their perceptions of the effectiveness of common efforts to prevent and respond to active shooters. I further investigate how news media exposure shaped these perceptions. I applied Protection Motivation Theory (PMT) to explore how perceptions and news media exposure might shape self-protective actions taken by individuals and their households. Data were obtained in 2019 from a cross-sectional, state-representative sample of 668 Pennsylvania adults who completed a web survey. Those who perceived higher community active shooter risk and those who felt community prevention and preparation efforts were effective were more likely to take self-protective steps themselves. Increased news exposure through apps, social media, family and friends was associated with increased perceived risk and effectiveness of prevention and preparation strategies. These results suggest that self-selected news and news through personal ties are linked to active shooter perceptions while other news mediums, like television or radio broadcasts, are not. News exposure was largely unrelated to self-protection. Those who felt community efforts were effective in prevention or preparation, however, were more likely to take self-protective actions. This finding indicates that community efforts may be more influential than news media in directing personal behavior.

**Keywords**: Self-protection, Perceived risk, Protection Motivation Theory, News media, Response efficacy

**Introduction**

 An active shooter is defined as a person who is killing or attempting to kill people with a firearm in a populated, often public area (Federal Bureau of Investigation [FBI], 2018b). Although frequently used synonymously, active shooters are not necessarily mass shooters; a person can be termed an active shooter even if only one or two individuals are targeted in the attack. Across 2016 and 2017, the FBI designated 50 total events as active shooter events (2018b). These incidents spanned 21 states and resulted in the deaths of 221 individuals, excluding the shooters. Earlier research by the FBI identified 160 active shooter events between 2000 and 2013 that resulted in 486 deaths; the number of such events increased each year over that time period (Blair & Schweit, 2014). However, active shooter events remain rare in comparison to homicides and other violent crimes. In 2017, there were an estimated 17,284 homicides in the U.S., a rate of 5.3 per 100,000 residents (FBI, 2018a). More than 70% of these involved firearms.

In this study, I focus on perceived risk, which is a person’s estimated likelihood of an active shooter event occurring. Despite low actual risk, 41.5% of respondents in Chapman University’s Survey of American Fears (2018) expressed that they were either afraid or very afraid of a mass shooting occurring. Elevated perceived risk has prompted schools, workplaces, law enforcement agencies, and private citizens to institute a variety of safeguards. Many schools now have policies that specify lockdown procedures and practice drills, wherein students and faculty hide and wait for an all-clear (Buerger & Buerger, 2010; Jagodzinski, 2019). Workplaces have been encouraged to practice what to do if an active shooter event occurs (drills) and to plan their response strategies in advance (Doherty, 2016; Romano et al., 2011). Other examples include law enforcement training and drills (Martínez, 2012), text and email alerts (Sattler et al., 2011), increasing physical security in facilities, and arming teachers and staff (Fox & DeLateur, 2014).

I investigate how members of the public perceive both active shooter risk and efforts to prevent and respond to active shooters. Many of the strategies noted above rely on the compliance of students, faculty, employees, and others. As a result, understanding their mindset is of critical importance in the development of prevention and intervention strategies (Campbell Institute, 2014). However, past studies have largely focused on perceptions of one or two strategies with isolated or unrepresentative samples. A rare exception was Jagodzinski (2019) who studied parent, teacher, and staff perceptions of school safety measures including emergency plans, fencing, and security cameras, among others. Findings revealed that all of these groups felt most positively about emergency plans, school resource officers, and bullet-resistant glass. While the study asked about an extensive list of protocols, it remained limited to schools and did not assess perceived risk. Extant research also neglected the possible influence of the news media on public perceptions of response strategies. I examine these issues with a representative sample of Pennsylvania residents.

**Protection Motivation Theory**

 I employ the Protection Motivation Theory (PMT) to investigate individual actions taken for self-protection against a possible active shooter event. For example, some people might develop an emergency plan, avoid travel, or purchase a firearm. PMT has been applied to a variety of contexts (Campbell Institute, 2014; Grothmann & Reusswig, 2006), but was initially developed to explain individuals’ perceived health risk and how they adopted safer or healthier behaviors as a result (Floyd et al., 2000). Early theorists investigated deliberate attempts to shape behavior, known as fear appeals, a misnomer given that they focused on perceived risk rather than fear. These appeals included efforts like media campaigns and physician-provided information that were intended to change individual perceptions of risk. Rogers (1975) proposed that there were three elements an appeal must address to change self-protective behavior: 1) perceived severity of the negative outcome, 2) perceived likelihood of that outcome occurring, and 3) perceived effectiveness of possible protective or preventive actions. Together, these three elements became known as the Health Behavior Model (Janz & Becker, 1984). I examine the latter two of these factors: perceived active shooter risk and perceptions of common community efforts to prevent or prepare for active shooters. Here, common community efforts include efforts at prevention such as background checks and mental health care, as well as efforts towards preparation like providing training, drills, or bullet-resistant materials to citizens and others.

Under the PMT framework, these perceptions constituted mediators (Floyd et al., 2000). Appeals (like media campaigns) are said to influence perceptions of risk, severity, and effectiveness of prevention options. These perceptions in turn, influence a person’s self-protective behavior (Floyd et al., 2000). Individuals become more likely to take self-protective action when they perceive a negative outcome as likely, as having serious consequences for themselves or others, and when they feel they have capacity, skills, or confidence to respond (Campbell Institute, 2014). The latter is known as self-efficacy. In this study, I investigate the impact of mass shooting and active shooter news exposure on individuals taking self-protective action. I further explore perceived risk and perceptions of common community efforts as possible mediators of the association between news exposure and these individual actions.

**News Coverage**

The news media shape perceptions of risk through selective coverage. In the weeks following the 2012 shooting at Sandy Hook Elementary in Newtown, Connecticut, 87% of respondents to a Gallup poll reported that they were following news of the shooting either somewhat or very closely (Saad, 2012). Not all events received equal coverage, however. Analysis of coverage by the *New York Times* found that shootings received more media attention in cases where there were more casualties, when shootings occurred in schools, when perpetrators were young, when the event appeared motivated by ideology, and when it involved the use of a variety of weapons (Silva & Capellan, 2019). News agencies have been criticized for overdramatization and overexposure. For some would-be shooters, receiving media attention can motivate violence (Dietz, 1986; Kissner, 2016). Florea (2013), in particular, made the argument that children and teenagers internalize violence in the news differently than adults. With high consumption, these individuals may grow up to believe that violence is normal and expected.

 Past research has observed that news coverage following mass shootings or active shooter events tended to frame guns, and sometimes gun owners, negatively (Seate et al., 2012). However, not all individuals respond to such coverage in the same way. Gun owners, in one study, were less likely to feel the coverage affected their own views and were more dismissive of the news coverage more generally (Seate et al., 2012). Other past research has found that interest in news coverage following a mass murder was higher among more fearful and younger respondents (Levin & Wiest, 2018). These individuals were also more likely to have school-age children.

**Perceived Risk**

 Fear and perceived risk are distinct concepts; the former focuses on emotions while the latter implies a rational calculation of the likelihood of an event occurring (Rountree & Land, 1996). In this study, I focus specifically on perceived risk. Previous studies have found that news exposure influences risk perceptions through danger-laden imagery (Zillmann et al., 1999); frequency of exposure (Lin & Lagoe, 2013); the degree to which individuals depend on the news media for information (Lin & Lagoe, 2013); and portrayal of victims’ emotion (Aust & Zillmann, 1996). Research from the field of public health has determined that news media exposure had a greater impact on perceived risk to others than perceived risk to oneself (Morton & Duck, 2001). However, high media exposure significantly impacted perceived personal risk. This was in part because it was associated with communicating with others about the news and risk (Morton & Duck, 2001). The general consensus is that individuals perceive themselves at higher risk when exposed to emotion- or fear-laden imagery, when frequently exposed to content related to risky events or negative outcomes, and when the news media are a key source of information for the individual.

 Perceived risk may drive individual behavior. Self-protection is the primary reason for gun ownership in the U.S (Swift, 2013). Both perceived risk and personal victimization increased the likelihood of having plans to purchase a gun (Kleck et al., 2011). Crime victims in other studies had an increased likelihood of taking other self-protective behaviors, such as installing alarms or avoiding certain areas (San-Juan et al., 2012). The same was observed for those who perceived themselves or their communities as being at higher risk of crime (Giblin et al., 2012). However, the influence of perceived risk on self-protection varies based on demographic traits. Females were more likely to engage in self-protection than males in one study, even after accounting for their perceived risk (Woolnaugh, 2009). Younger individuals, in other research, were more likely to engage in avoidant behaviors rather than take active steps to increase personal safety (San-Juan et al., 2012). Past studies have found no differences between rural and urban residents (Giblin et al., 2012).

 The tenets of both the Health Belief Model (Janz & Becker, 1984) and Social Learning Theory propose that individuals are more likely to adopt behaviors that they feel confident they can perform and perform effectively, which Bandura (1977) has termed self-efficacy. Past research confirmed that individuals were more likely to engage in self-protection when self-efficacy for these behaviors was high (Hichang, 2010). Appeals were also more effective in changing behavior among those with higher self-efficacy (Manyiwa & Brennan, 2012). I extend this research by examining the perceived effectiveness of active shooter preparedness and response strategies, also known as response efficacy (Lewis, Watson, & White, 2010). In other words, response efficacy refers to whether individuals feel community efforts like training, drills, or background checks are effective in preventing active shooter events or preparing the community and citizens to better respond to an active shooter event in progress. I hypothesize that individuals would be more likely to take self-protective actions themselves when they believe community efforts like these are effective. Research on perceived active shooter response efficacy is currently limited. However, Landry and colleagues (2018) found that an active shooter education program for nurses and other non-management health staff was effective in increasing perceptions of hospital preparedness as well as increasing knowledge of appropriate individual actions. These results suggest that community or workplace efforts may impact both individual perceptions and individual behavior.

**Methods**

I obtained data from a web survey that was administered for a month in February 2019. After I designed the survey, the Qualtrics survey research company was tasked with recruiting a sample of 650 Pennsylvania residents, adults aged 18 or older who were English proficient to complete the survey. Qualtrics was responsible for both locating respondents and administering the survey. Qualtrics routinely collects data from market research panels consisting of English-speaking, non-institutionalized adults. Participants who completed the survey received small incentives from Qualtrics including sky miles or points that could be redeemed for gift cards. For this study, Qualtrics contacted 4,139 potential respondents selected to mirror 2017 Pennsylvania demographics for age, household income, urbanicity, gender, race and ethnicity (U.S. Census Bureau, 2019). Since 2017 is between U.S. Census data collections, these estimates were based on the American Community Survey, facilitated by the U.S. Census Bureau. The company emailed each of these individuals an invitation that listed the title and anticipated length of the study, but did not elaborate on study contents. All study procedures were approved by the Penn State University IRB. Informed consent was obtained from all individual participants included in the study.

Of those who responded (1,085 or a 26% response rate), 93 were too young and 51 did not consent. Another 11 were ineligible due to limited English proficiency, and 68 were ineligible because they did not reside in Pennsylvania. A further 184 responses were excluded from analysis because respondents failed data quality checkpoints (i.e., select “strongly agree” to show you are reading this question) or because they completed the survey too quickly (<1/3 of the median response time) indicating a lack of attentiveness. Quotas were used to cap responses from demographic subgroups (age, household income, urbanicity, gender, race and ethnicity) once responses in proportion to their occurrence in the Pennsylvania population were received; only 10 respondents were deemed ineligible to participate because quotas were already met. The final sample consisted of 668 individuals, which constitutes a 16% response rate based on initial email invitations, or that 62% were eligible to participate out of those who responded to the email invitation. Respondents took an average of 18.2 min to complete the survey. Access to the survey was instantaneous once respondents clicked the provided survey link. Respondents were assured that their answers were confidential. All respondents were assigned unique identification numbers by Qualtrics; no personal identifiers were collected. The survey defined an active shooter event as “when an individual is actively killing or attempting to kill people with a firearm in a populated area.”

**Measures**

**Dependent variable**

 The survey asked about *self-protection*: “To your knowledge, have you or others in your household done any of the following things to protect yourself or household members from an active shooter event? Please select all that apply.” Response options (presented as a list of checkboxes) included: developed emergency plans, purchased a firearm, purchased other things to increase safety, read about active shooters, attended training, reduced airline travel, reduced travel by train, reduced use of public transportation, avoided travel overseas, avoided travel to certain cities, avoided state or national landmarks, changed schools, moved to a different neighborhood, and avoided public spaces. I classified the first five of these items as proactive behaviors and the latter nine as avoidant behaviors. The total count of proactive behaviors, the total count of avoidant behaviors, and the total count of all 14 possible self-protective behaviors were modeled as dependent variables. A respondent could score a minimum of 0 or a maximum of 5 for the proactive total, 9 for the avoidant total, and 14 for the self-protective total.

**Independent variables**

 Two items assessed *media exposure*. The first asked “How often have you seen, heard, or received news related to mass shootings or gun violence from the following sources in the past year?” Sources listed print newspapers, news on the radio, local television news, national television news, social networking sites, websites, friends, phone or tablet apps, and family members. Participants could choose one of the following response options for each source: multiple times a day (7), nearly every day (6), a few times a week (5), once a week (4), a few times a month (3), less often (2), and never (1); the “not applicable” response option was coded as missing data. Each location was scored separately. A follow-up question asked respondents “On how many of the last 7 days did you see, hear, or receive news related to mass shootings or gun violence?” Response options ranged from 0 to 7 days. No option for not applicable was given.

**Mediating variables.**

 To measure *perceived risk*, respondents were asked “In your opinion, how likely or unlikely is it that an active shooter event will occur in each of these locations in the next 6 months?” Locations listed were: somewhere in the nation; in your neighborhood; at a school that you personally attend; somewhere in Pennsylvania; at your workplace; in your city, town, or local area; in a local mall or shopping area; at a local restaurant; at a local bar or pub; and on a local bus, train, subway, or other form of public transportation. Response options included “not applicable” or ranged from 0 (extremely unlikely), 2 (moderately likely or unlikely), to 4 (extremely likely). Not applicable responses were coded as missing. Item-level responses were averaged to form a mean measure of perceived risk (alpha = 0.92) with a range of 0 to 4. Principal factor analysis with these items found only one eigenvalue greater than one and all items loaded positively on the same factor.

 Respondents were presented with two items to measure *perceived response efficacy*. Each was a separate predictor. The first asked “In your opinion, how effective or ineffective are each of the following in preparing people for active shooter events?” Statements included: developing emergency plans, practicing (drills of) what to do if an active shooter event occurs, completing video-based training about active shooters, reading information about active shooters, self-defense training, and learning how to operate a firearm. For each of these six statements, response options ranged from 1 (extremely ineffective) to 5 (extremely effective) with 3 as neither effective nor ineffective.

The second item used to measure perceived response efficacy was “In your opinion, how effective or ineffective are each of the following for preventing active shooter events?” Response options were the same as the previous items. Statements included installing bulletproof or bullet-resistant materials in buildings; police patrol; mental health care; patrol by security personnel; background checks; citizens carrying concealed firearms; restrictions on gun accessories; requiring students, staff, etc. to wear visible identification; secure gun storage in homes; metal detectors; allowing teachers to have firearms at school; clear backpacks; citizens openly carrying firearms; security checkpoints in buildings; video cameras; harsher punishments for gun crimes; and school suspension and expulsion. Item-level responses for each survey question were averaged to form a mean measure of preparation response efficacy (alpha = 0.83) and a mean measure of prevention response efficacy (alpha = 0.88). Principal factor analysis with the items from each survey question indicated loading on a single factor.

**Control variables**

 Control measures included sex (male = 1, female = 0), race and ethnicity as dummy-coded variables (White/non-White, Black/non-Black, Asian/non-Asian, Hispanic/non-Hispanic), age in years, level of education (less than high school, high school, some college, two-year degree, four-year degree, graduate degree), household income (under $20K, $20K to $29,999, $30K to $39,999, …, $100K+), current marital status (single, married or cohabiting, divorced or separated, widowed), household gun ownership (yes/ no), and criminal, physical victimization in the past two years (yes/ no).

**Analysis Plan**

 All analyses were completed using the *StataSE 15.0* software. To test whether perceived risk and perceived response efficacy mediate the impact on news exposure on self-protective behaviors, I followed the approach to testing mediation suggested by Baron and Kenny (1986). The first step was to establish whether news exposure was associated with self-protective actions. I employed negative binomial regression because the variance of each self-protection variable was much larger than its mean and because the self-protection variables were positively skewed, with a skewness value of 1.5 for the total, 2.4 for avoidant actions, and 0.89 for proactive actions. I next assessed whether news exposure was associated with the proposed mediators, perceived risk and perceived response efficacy, by treating perceived risk and perceived response efficacy as outcomes. I used Ordinary least squares (OLS) regression to examine impact of news exposure on both. Lastly, I conducted negative binomial models with both news exposure and the possible mediators entered as predictors of self-protective actions. This step is important to show not only that the proposed mediators are associated with self-protective actions, but that the effect of news exposure is reduced to zero or non-significance when mediators are included in the analysis (i.e., perceived risk and perceived response efficacy fully mediate the news exposure- self-protection relationship).

Since perceived crime risk is known to vary by gender and race/ethnicity, I also conducted supplemental models testing for possible multiplicative interactions between gender and perceived risk (male\*perceived risk) and between race and ethnicity and perceived risk (Black\*perceived risk, Asian\*perceived risk, Hispanic\*perceived risk). Missing data were minimal (< 1%); each model was estimated using complete case analysis. Both income and level of education were treated as continuous variables in regression models. All models were estimated using robust standard errors, which are more ideal for small samples and result in more conservative conclusions about statistical significance.

**Results**

**Sample characteristics**

 By design, the sample was selected to be representative of Pennsylvania adults aged 18 or older using 2017 U.S. Census estimates (U.S. Census Bureau, 2019). Sample characteristics for ordinal and continuous measures are displayed in Table 1, and those for categorical variables are shown in Table 2. As an overview, respondents had an average age of 47 years, and were mostly female (53%), White (65%), and married (55%). In total, 24% of respondents reported an income of $100,000 or more, which indicates that the respondents had a higher income, on average, than Pennsylvania residents more generally (U.S. Census Bureau, 2019). Only 23% of respondents reported having never attended college. A small portion of the sample (8%) reported experiencing a criminal victimization in the past two years.

INSERT TABLES 1 and 2 ABOUT HERE

Regarding attitudes and behavior, respondents reported taking an average of 1.8 (out of 14) self-protective actions in total. Proactive actions (mean=1.0 out of 5) were slightly more common than avoidant actions (mean= 0.8 out of 9). On average, respondents perceived the risk of an active shooter event as moderate, at 1.9 on a scale of 0 to 4. No skewness was observed for perceived risk. Respondents perceived existing prevention and response measures as moderately effective, on average, with a 3.2 on the 1 to 5 scale for preparation and a 3.2 for prevention. Neither measure was skewed. Average news exposure across respondents varied by medium but ranged from hearing about mass shootings or gun violence a few times a month to once a week. For print news, as one example, the average was 2.6, or a few times a month. For local television, the average was 3.7, or about once per week. Skewness was mild for these measures with all skewness values at 0.9 or less. Respondents reported hearing about these topics 1.6 times in the past week, on average. This measure had a positively skewed value of 1.4.

**News exposure and self-protection**

 The first step in assessing mediation was to test for an association between news media exposure and self-protective actions taken by respondents. The first panel of Table 3 displays results of negative binomial regression models predicting self-protective actions with news exposure as key predictors, along with demographic controls. In all models, married was the reference category for marital status and White was the reference category for race and ethnicity. For avoidant behaviors, there was a positive coefficient of 0.2 for national television news exposure; increases in exposure were associated with increases in avoidant behaviors taken. More specifically, every unit increase in exposure was associated with a 17% increase in the count of avoidant behaviors (incidence rate ratio). Likewise, a positive coefficient of 0.6 indicated that prior crime victims took more avoidant actions than non-victims. Negative coefficients of -0.3 and -0.5 for single and divorced/separated respondents, respectively, further indicated that these groups engaged in less avoidant behaviors than married respondents.

INSERT TABLE 3 ABOUT HERE

For proactive behaviors, a positive coefficient of 0.05 for past week news exposure indicated that more exposure, overall, was associated with taking more proactive behaviors (5% increase). A coefficient of -0.01 for age was observed, showing a slight (1%) decrease in proactive behaviors with each year of age. The crime victim coefficient was 0.4 for proactive behaviors, showing a similar pattern to avoidant behaviors. For total self-protective actions, the past week news and age coefficients remained the same as in the proactive model. A coefficient of 0.5 was observed for criminal victimization. Lastly, a coefficient of 0.2 for gun ownership indicated that gun owners took more self-protective actions than non-owners. Overall, there was limited evidence of an association between news exposure and self-protective action. Overall past week exposure and national television exposure were associated with the outcomes, but not other mediums.

**News exposure and mediators**

I next assessed whether news exposure was associated with the proposed mediators, perceived risk and perceived response efficacy, by treating perceived risk and perceived response efficacy as outcomes. I used Ordinary least squares (OLS) regression to examine the impact of news exposure on both. Results of these models are shown in Table 4. Standardized beta coefficients are displayed with the same reference categories of marital status and race and ethnicity as before.

INSERT TABLE 4 ABOUT HERE

The first column examines perceived effectiveness of prevention strategies. Coefficients of 0.1 showed that those with more news exposure through social media or local television felt that prevention strategies were more effective than those with less exposure to news from these mediums. Age and education, in contrast, had coefficients of -0.2 and -0.1, respectively. These indicate a decrease in perceived prevention effectiveness with each increase in age or level of education. A coefficient of -0.1 further showed that Asians perceived these strategies as less effective than Whites.

The second column shows comparable results for perceived preparation strategy effectiveness. Again, greater exposure through social media (0.2 coefficient) was associated with greater perceived response efficacy. Number of days of exposure in the past week and family-based news exposure were associated with decreases in perceived response efficacy with coefficients of -0.1 and -0.1, respectively. In other words, people exposed to more gun news and people who received more of their news from family members were less confident in common community, workplace, and school response strategies. Lastly, a positive coefficient for household gun owners (0.2) showed that gun owners had higher perceived effectiveness than non-owners.

The last column examines associations with perceived risk. Number of days of exposure in the past week and app-based news exposure were associated with increases in perceived risk, with coefficients of 0.1 and 0.2, respectively. Perceived risk also increased with age (0.1 coefficient) but decreased as income increased (-0.1 coefficient). Supplemental models (not shown) with these same predictors were assessed with the additional multiplicative interaction terms of male\*perceived risk and each race/ethnicity category \* perceived risk. No evidence of a gender or race/ethnicity interaction was observed. Overall, there was limited evidence that news exposure associated with the proposed mediators. Both direction and type (which news medium) of effect varied from model to model.

**News exposure, mediators, and self-protection**

Lastly, the second panel of Table 3 shows results from negative binomial models with both news exposure and the possible mediators entered as predictors of self-protective actions. These models are estimated to test whether the proposed mediators are associated with self-protective actions, and also that the effect of news exposure is reduced to zero or non-significance when mediators are included in the analysis (i.e., perceived risk and response efficacy fully mediate the news exposure - self-protection relationship). The significant association between national television exposure and avoidant behaviors remained (coefficient of 0.2). For proactive behaviors, the association (coefficient of 0.1) with past week news exposure was no longer statistically significant. However, for the total count of self-protective behaviors, there was no change in the association with past week news exposure. Together, these results suggest that perceived risk and perceived response efficacy do not mediate the effect of news media exposure on self-protection. While the past week news exposure association was reduced to non-significance for proactive behaviors, there was no such attenuation for other news exposure measures.

**Discussion**

 Using the framework of Protection Motivation Theory (PMT; Floyd et al., 2000), I assessed exposure to news coverage of mass shootings and active shooters as a possible form of fear appeal. I tested perceived active shooter risk and perceptions of the effectiveness of prevention and preparation strategies (i.e., response efficacy) as possible mediators of the link between news exposure and taking self-protective action. I found that these two factors, posited as mediators in the PMT framework (Floyd et al., 2000; Rogers, 1975), did not seem to mediate the link between news exposure and self-protective actions.

 I found inconsistent and limited evidence of an association between news media exposure and the proposed mediators. Increased exposure through apps, social media, and family were associated with perceived risk and increased perceived response efficacy. No significant associations were observed for other mediums. These forms of exposure all involve some degree of on-demand or “instant” exposure. A person can log onto an app, scroll through a social media news feed, or chat with a friend to obtain information. There is no need to wait for a story to appear at a prescribed hour. Further, apps and social media are easily accessible on mobile devices; some television networks, in contrast, may require a paid subscription. The results of my analysis suggest that individual perceptions are shaped through communication with others about risk (Morton & Duck, 2001). Typical “public education” campaigns that rely on more passive delivery of information through ads may be ineffective in shaping perceived risk or in encouraging individuals to adopt self-protective actions as a result.

That apps and social media emerged as influential may reflect trends in news media consumption. As of 2017, 43% of Americans reported often getting news online, and two-thirds reported getting at least some of their news from social media sites like Twitter (Gottfried & Shearer, 2017). Only 25% and 18% reported often getting news from radio or print sources, respectively (Gottfried & Shearer, 2017). It is also possible that one form of exposure may have led individuals to seek out further information through a related news medium. Bialik and Matsa (2017) found that follow-up actions taken as a response to digital news exposure most often occurred online as well. For instance, someone noticing a social media post might repost the story to their personal feed or email a link to a friend. Emails or texts from friends were the form of exposure most likely to result in a follow-up action (Bialik & Matsa, 2017). Additionally Morton and Duck (2001) found that high media exposure (at least through newspapers) was associated with higher likelihood of communicating with others about risk and news content. These trends could partially explain why apps, social media, family and friends were all influential sources of news media exposure. All involve interpersonal communication rather than passive receipt of news coverage.

Perceived risk of active shooter events among many respondents was disproportionally high in relation to actual risk (FBI, 2018a, 2018b). More than 10% of respondents felt the occurrence of such an event was very or extremely likely, on average. While downplaying risk would be counterproductive to prevention and preparation efforts, past studies have determined that individuals with higher levels of fear were more likely to experience depression, exercised less, and spent less time in social activities (Dolan & Peasgood, 2007; Stafford et al., 2007). Some approaches to prepare for active shooters, like installing bulletproof materials, have been associated with increases in fear (Fox & DeLateur, 2014). Yet these are often efforts made by organizations that do not involve input or participation from members of the public. These trends suggest that efforts to empower individuals (e.g., with training, drills) may be a more appropriate strategy to prepare the public for the possibility of an active shooter event.

I found that app news exposure and overall past week exposure to news about shootings was positively associated with perceived risk. Although the content of news exposure was not measured, overdramatization and overexposure have been criticisms lobbied against television media in particular (Dietz, 1986; Florea, 2013). It is possible that such exposure makes shootings seem more common than they actually are, thereby increasing perceived risk. Additionally, the selective coverage of certain types of shootings may leave viewers with skewed impressions about their “typical” characteristics or severity (Silva & Capellan, 2019). A competing explanation may be self-selection; more fearful respondents may have sought out shooting-related news coverage (Levin & Wiest, 2018). The survey did not assess the degree to which exposure included seeking out information versus encountering it more passively. However, the results suggest that recommendations to remove the names of active shooters from news coverage or to limit the amount of sensational or graphic material from coverage may help to mitigate not only the occurrence of “copycat” shootings but may also help viewers more accurately assess risk to themselves and their communities.

Associations with perceived response efficacy were more variable. Perceived preparation response efficacy was significantly associated with proactive but not avoidant behaviors. Preparation responses included development of emergency plans and various forms of training. Likewise, proactive self-protective behaviors included actions such as attending training, developing emergency plans, and purchasing supplies. Both concepts largely involve deliberately taking action. Perceived prevention response efficacy, however, was significantly associated with avoidant behaviors but not proactive behaviors. Prevention responses included efforts to reduce gun availability or the likelihood of a gun being present in a public space. Many of these responses are passive and involve changes to the physical structure, law, or efforts where no direct action is required of civilians. To some degree, this matches the notion of avoidant behaviors, which involve more inaction than action.

This line of examination built on research examining self-efficacy more generally. Past research has determined that individuals were more likely to engage in self-protection when their level of self-efficacy was high (Hichang, 2010). Like my own results, Lam (2006) found individuals’ perceptions of the effectiveness of alternative solutions to a problem influenced their own behavioral intentions. Specifically, respondents were less likely to take a particular action if they perceived the alternatives as more effective. From this finding, the author concluded that one way to increase a particular response was to highlight its advantages over other strategies (Lam, 2006). One practical implication is that efforts to attain public support or cooperation with a given strategy may depend on shaping public views about a given approach’s effectiveness in comparison with other options.

The overall structure of PMT was not supported by my investigation. Perceived risk and perceived response efficacy did not mediate the effects of news media exposure on self-protective action. To some extent, this trend may reflect the role of demographic and background characteristics. Prior victimization, for instance, was strongly related to self-protective action; age was significantly related to beliefs about response efficacy. Past studies found that the influence of fear and perceived risk on self-protection varied by traits like these (San-Juan et al., 2012; Woolnaugh, 2009). It is possible that some of these traits may override the impact of a fear appeal for certain individuals.

**Limitations and Directions for Future Research**

 My investigation has several limitations that may be addressed with further research. First, the study is cross-sectional. Changes in views over time were not measured, nor was the timing of when respondents first took the self-protective actions they indicated. Respondents were asked about both past year and past week exposure; error in recall may increase as length of recall period increases. Second, all respondents originated from a market research panel. As these individuals take surveys for cash and other incentives, some degree of self-selection bias is likely. Further, some degree of self-selection bias is possible given that the title of the study was “Active Shooter Preparation,” a term that could be controversial or upsetting to some individuals. The use of a quota-based sample is also potentially problematic because it is not equivalent to random selection; quotas did not perfectly match demographic proportions in the Pennsylvania population. Third, I did not measure the precise content of the news media to which respondents were exposed. We do not know, for example, if respondents were exposed to coverage of shootings in progress, of funerals and other aftermath, or more factual accounts of trends over time, etc. It remains plausible that certain types of news coverage serve as fear appeals (i.e., following the pattern suggested by PMT) while others do not.

 A fourth concern is that I did not directly measure perceived personal risk. While respondents were asked to estimate perceived risk of an active shooter event occurring in their workplace, school, and so on, they were not asked their perceived risk of being a victim themselves. They were also not asked to what extent they believed protective or preventive measures were effective in protecting themselves, personally. For these reasons, perceived risk and response efficacy may have been less personal to the respondent, possibly limiting the extent to which the principles of PMT, as they relate to behavior change, might apply. This measurement limitation may also explain why no interaction with gender or race/ethnicity was observed. Additional study is needed to examine perceived risk to self more directly.

Lastly, I did not examine perceived seriousness, the third suggested mediator of PMT (Floyd et al., 2000; Rogers, 1975). Given critiques of the media overdramatizing active and mass shootings (Dietz, 1986; Florea, 2013) as well as selective coverage (Silva & Capellan, 2019), this mediator may be of particular interest for this topic. Perceived severity is distinct from perceived risk. Perceived risk refers to perceptions of the likelihood of an event occurring while perceived severity refers more to the impact and extent of the event should it occur. Since past research found shootings with more casualties received more coverage (Silva & Capellan, 2019), individuals may make incorrect assumptions about death and injury tolls. These assumptions, in turn, could affect their likelihood of taking various self-protective actions. Without a measure for this third mediator, a full test of mediation under the PMT framework is not possible.

**Conclusion**

 I used data from a quota sample of Pennsylvania adults to investigate the role of news media exposure, perceived risk, and perceived response efficacy on self-protective behaviors taken in response to active shooters. Following the framework of Protection Motivation Theory, I modeled perceived risk and perceived response efficacy as possible mediators of news exposure related to mass shootings and gun violence. I found no evidence of a mediation effect. News media exposure had only limited association with self-protection or the mediators tested. However, further investigation into the content of news media and into perceived severity of active shooter events is needed to fully test the theory’s applicability for this topic. Results indicate that the specific type of self-protective actions taken by residents depends on their perceptions of various response options. This finding highlights the need for targeted efforts relying on interpersonal communication rather than general messages to the public about preparation or prevention.

**Ethical approval:** All procedures performed involving human participants were approved by the Penn State Institutional Review Board and were in accordance with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

**Conflict of Interest**

The author declares she has no conflict of interest.

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Table 1. Sample characteristics for ordinal and continuous measures (*N* = 668)

|  |  |  |  |
| --- | --- | --- | --- |
| **Variable** | ***n*** | **Mean (*SD*)** | **Range** |
| Age | 664 | 46.4 (17) | (18, 89) |
| Avoidant self-protection | 668 | 0.8 (1.4) | (0, 9) |
| Proactive self-protection | 668 | 1.0 (1.1) | (0, 4) |
| Total self-protection | 668 | 1.8 (2.0) | (0, 13) |
| Perceived risk | 662 | 1.9 (0.9) | (0, 4) |
| Perceived preparation | 668 | 3.2 (0.8) | (1, 5) |
| Perceived prevention | 668 | 3.2 (0.4) | (1.7, 4.2) |
| Print | 668 | 2.6 (1.6) | (1, 7) |
| Radio | 668 | 2.9 (1.6) | (1, 7) |
| National TV | 668 | 3.4 (1.6) | (1, 7) |
| Local TV | 668 | 3.7 (1.8) | (1, 7) |
| Website | 668 | 3.1 (1.8) | (1, 7) |
| App | 668 | 2.9 (1.9) | (1, 7) |
| Social network | 668 | 3.1 (2.0) | (1, 7) |
| Friend | 668 | 2.9 (1.6) | (1, 7) |
| Family | 668 | 2.8 (1.5) | (1, 7) |
| Past week news | 660 | 1.6 (1.8) | (0, 7) |

*Note.* *SD* = standard deviation

Table 2. Sample characteristics for categorical measures (*N* = 668)

|  |  |  |  |
| --- | --- | --- | --- |
| **Variable** | ***n*** | **Proportion** | **95% CI** |
| Male | 316 | 47.3% | (0.4, 0.5) |
| Prior crime victim | 52 | 7.8% | (0.1, 0.10) |
| Household gun owner | 200 | 29.9% | (0.3, 0.3) |
|  *Race and ethnicity:* White | 432 | 64.7% | (0.6, 0.7) |
| Black | 84 | 12.6% | (0.1, 0.2) |
| Asian | 35 | 5.2% | (0.0, 0.1) |
| Hispanic | 101 | 15.1% | (0.1, 0.2) |
| *Income*: < $20K | 91 | 13.7% | (0.1, 0.2) |
| $20K - $29,999 | 55 | 8.3% | (0.1, 0.1) |
| $30K - $39,999 | 55 | 8.3% | (0.1, 0.1) |
| $40K - $49,999 | 64 | 9.6% | (0.1, 0.1) |
| $50K - $59,999 | 47 | 7.1% | (0.1, 0.1) |
| $60K - $69,999 | 47 | 7.1% | (0.1, 0.1) |
| $70K - $79,999 | 46 | 6.9% | (0.1, 0.1) |
| $80K - $89,999 | 46 | 6.9% | (0.1, 0.1) |
| $90K - $99,999 | 45 | 6.8% | (0.1, 0.1) |
| $100K + | 157 | 23.6% | (0.2, 0.3) |
| *Education*: < High school | 16 | 2.4% | (0.0, 0.0) |
| High school | 138 | 20.7% | (0.2, 0.2) |
| Some college, no degree | 132 | 19.8% | (0.2, 0.2) |
| 2-year degree | 73 | 10.9% | (0.1, 0.1) |
| 4-year degree | 177 | 26.5% | (0.2, 0.3) |
| Graduate degree | 132 | 19.8% | (0.2, 0.2) |
| *Marital status:* Single | 213 | 31.9% | (0.3, 0.4) |
| Married or cohabiting | 365 | 54.6% | (0.5, 0.6) |
| Separated or divorced | 72 | 10.8% | (0.1, 0.1) |
| Widowed | 18 | 2.7% | (0.0, 0.0) |

*Note.* CI = confidence interval. *n =* refers to the count for a particular response category.

Table 3. Negative binomial regression models predicting sum of self-protective actions (*n* = 656)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Variable** | **Avoidant** | **Proactive** | **Total** | **Avoidant** | **Proactive** | **Total** |
| Print | -0.0 |  | (0.1) | 0.0 |  | (0.0) | 0.0 |  | (0.0) | -0.0 |  | (0.1) | 0.0 |  | (0.0) | 0.0 |  | (0.0) |
| Radio | 0.0 |  | (0.1) | 0.0 |  | (0.0) | 0.0 |  | (0.0) | 0.0 |  | (0.1) | 0.0 |  | (0.0) | 0.0 |  | (0.0) |
| National TV | 0.2 | \* | (0.1) | -0.0 |  | (0.0) | 0.1 |  | (0.1) | 0.2 | \* | (0.1) | -0.0 |  | (0.0) | 0.0 |  | (0.1) |
| Local TV | -0.1 |  | (0.1) | -0.0 |  | (0.0) | -0.1 |  | (0.0) | -0.1 |  | (0.1) | -0.0 |  | (0.0) | -0.1 |  | (0.0) |
| Website | 0.0 |  | (0.1) | 0.0 |  | (0.0) | 0.0 |  | (0.0) | 0.0 |  | (0.1) | 0.0 |  | (0.0) | 0.0 |  | (0.0) |
| App | -0.1 |  | (0.1) | 0.0 |  | (0.0) | 0.0 |  | (0.0) | -0.1 | \* | (0.1) | 0.1 |  | (0.0) | -0.0 |  | (0.0) |
| Social network | 0.1 |  | (0.1) | 0.1 |  | (0.0) | 0.1 |  | (0.0) | 0.1 |  | (0.1) | 0.0 |  | (0.0) | 0.1 |  | (0.0) |
| Friend | 0.1 |  | (0.1) | 0.0 |  | (0.0) | 0.0 |  | (0.0) | 0.0 |  | (0.1) | 0.0 |  | (0.0) | 0.0 |  | (0.0) |
| Family | -0.0 |  | (0.1) | -0.0 |  | (0.0) | -0.0 |  | (0.0) | -0.0 |  | (0.1) | -0.0 |  | (0.0) | -0.0 |  | (0.0) |
| Past week news  | 0.1 |  | (0.0) | 0.1 | \* | (0.0) | 0.1 | \* | (0.0) | 0.1 |  | (0.0) | 0.1 |  | (0.0) | 0.1 | \* | (0.0) |
| Perceived risk |  |  |  |  |  |  |  |  |  | 0.2 | \* | (0.1) | 0.1 |  | (0.1) | 0.1 | \* | (0.1) |
| Perceived preparation  |  |  |  |  |  |  |  |  |  | 0.0 |  | (0.1) | 0.2 |  | (0.1) | 0.1 |  | (0.1) |
| Perceived prevention  |  |  |  |  |  |  |  |  |  | 0.5 | \* | (0.2) | 0.1 |  | (0.1) | 0.2 |  | (0.1) |
| Age | -0.0 |  | (0.0) | -0.0 | \*\* | (0.0) | -0.0 | \* | (0.0) | -0.0 |  | (0.0) | -0.0 |  | (0.0) | -0.0 | \* | (0.0) |
| Male | -0.3 |  | (0.2) | -0.1 |  | (0.1) | -0.2 |  | (0.1) | -0.3 | \* | (0.2) | -0.1 |  | (0.1) | -0.2 |  | (0.1) |
| Household gun owner | 0.2 |  | (0.1) | 0.2 |  | (0.1) | 0.2 | \* | (0.1) | 0.2 |  | (0.2) | 0.1 |  | (0.1) | 0.2 |  | (0.1) |
| Prior crime victim | 0.6 | \*\* | (0.2) | 0.4 | \*\* | (0.1) | 0.5 | \*\* | (0.1) | 0.7 | \*\* | (0.2) | 0.4 |  | (0.1) | 0.6 | \*\* | (0.1) |
| Black | -0.1 |  | (0.2) | -0.2 |  | (0.2) | -0.1 |  | (0.1) | -0.1 |  | (0.2) | -0.2 |  | (0.2) | -0.2 |  | (0.1) |
| Asian | -0.1 |  | (0.3) | -0.2 |  | (0.2) | -0.2 |  | (0.2) | -0.0 |  | (0.3) | -0.1 |  | (0.2) | -0.1 |  | (0.2) |
| Hispanic | -0.4 |  | (0.2) | -0.1 |  | (0.1) | -0.2 |  | (0.1) | -0.4 | \* | (0.2) | -0.1 |  | (0.1) | -0.2 |  | (0.1) |
| Income | -0.1 |  | (0.0) | 0.0 |  | (0.0) | -0.0 |  | (0.0) | -0.0 |  | (0.0) | 0.0 |  | (0.0) | -0.0 |  | (0.0) |
| Education | -0.0 |  | (0.1) | 0.0 |  | (0.0) | 0.0 |  | (0.0) | -0.0 |  | (0.1) | 0.0 |  | (0.0) | 0.0 |  | (0.0) |
| Single | -0.3 | \* | (0.2) | -0.0 |  | (0.1) | -0.1 |  | (0.1) | -0.3 |  | (0.2) | 0.0 |  | (0.1) | -0.1 |  | (0.1) |
| Separated or divorced | -0.5 | \* | (0.3) | 0.1 |  | (0.2) | -0.1 |  | (0.2) | -0.5 | \* | (0.3) | 0.2 |  | (0.2) | -0.1 |  | (0.2) |
| Widowed | 0.1 |  | (0.3) | 0.1 |  | (0.3) | 0.2 |  | (0.3) | 0.2 |  | (0.4) | 0.2 |  | (0.3) | 0.3 |  | (0.3) |
| Constant | 0.4 |  | (0.1) | -0.1 |  | (0.2) | 0.5 | \* | (0.1) | -1.8 | \* | (0.7) | -14.3 |  | (0.4) | -0.7 |  | (0.5) |

*Note.* Robust standard errors in parentheses.

\* *p*< 0.05. \*\* *p*< 0.01.

Table 4. Ordinary least squares (OLS) regression models predicting perceived risk and response efficacy, standardized coefficients shown (*n* = 642)

|  |  |  |  |
| --- | --- | --- | --- |
| **Variable** | **Prevention efficacy** | **Preparation efficacy** | **Perceived risk** |
| Print | -0.1 |  | (0.0) | -0.0 |  | (0.0) | 0.0 |  | (0.0) |
| Radio | -0.0 |  | (0.0) | -0.0 |  | (0.0) | 0.1 |  | (0.0) |
| National TV | 0.1 |  | (0.0) | 0.1 |  | (0.0) | -0.0 |  | (0.0) |
| Local TV | 0.1 | \* | (0.0) | 0.1 |  | (0.0) | 0.1 |  | (0.0) |
| Website | -0.1 |  | (0.0) | -0.1 |  | (0.0) | -0.0 |  | (0.0) |
| App | 0.1 |  | (0.0) | -0.0 |  | (0.0) | 0.2 | \*\* | (0.0) |
| Social network | 0.1 | \* | (0.0) | 0.2 | \*\* | (0.0) | -0.1 |  | (0.0) |
| Friend | 0.0 |  | (0.0) | 0.1 |  | (0.0) | 0.1 |  | (0.0) |
| Family | -0.1 |  | (0.0) | -0.1 | \* | (0.0) | -0.0 |  | (0.0) |
| Past week news  | -0.1 |  | (0.0) | -0.1 | \*\* | (0.0) | 0.1 | \* | (0.0) |
| Age | -0.2 | \*\* | (0.0) | -0.1 |  | (0.0) | 0.1 | \*\* | (0.0) |
| Male | 0.0 |  | (0.0) | 0.0 |  | (0.1) | -0.1 |  | (0.1) |
| Household gun owner | 0.0 |  | (0.0) | 0.2 | \*\* | (0.1) | 0.1 |  | (0.1) |
| Prior crime victim | -0.0 |  | (0.1) | -0.0 |  | (0.1) | 0.0 |  | (0.1) |
| Black | 0.0 |  | (0.1) | 0.1 |  | (0.1) | 0.1 |  | (0.1) |
| Asian | -0.1 | \*\* | (0.1) | -0.1 |  | (0.1) | 0.1 |  | (0.1) |
| Hispanic | -0.0 |  | (0.1) | 0.0 |  | (0.1) | 0.0 |  | (0.1) |
| Income | -0.0 |  | (0.0) | -0.0 |  | (0.0) | -0.1 | \*\* | (0.0) |
| Education | -0.1 | \* | (0.0) | -0.1 |  | (0.0) | -0.0 |  | (0.0) |
| Single | -0.1 |  | (0.0) | -0.0 |  | (0.1) | 0.0 |  | (0.1) |
| Separated or divorced | -0.0 |  | (0.1) | -0.0 |  | (0.1) | -0.0 |  | (0.1) |
| Widowed | 0.0 |  | (0.1) | -0.0 |  | (0.2) | -0.0 |  | (0.2) |
|  Constant | 3.3 | \*\* | (0.1) | 3.3 | \*\* | (0.2) | 1.3 | \*\* | (0.2) |
| R-Squared | 0.1 |  |  | 0.1 |  |  | 0.2 |  |  |

*Note.* Robust standard errors in parentheses.

\* *p*< 0.05. \*\* *p*< 0.01.