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ORIGINAL RESEARCH

Harnessing Fear and Promoting Self-Efficacy in Response to Mass Casualty Scenarios: Evaluating Stop the Bleed at an Urban University

Stephanie Tom Tong[1] · Kirby Phillips[1] · Joseph Gomez[2] · Damon Gorelick[3] · Matthew Seeger[1]

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Abstract

Emergency situations range from everyday traffic accidents to incidents of mass gun violence and require individuals to be prepared and willing to act in times of crisis. To encourage people to help one another during such emergencies, the American College of Surgeons developed the *Stop the Bleed* (STB), a public health program based on the premise that bystanders who are properly trained to treat a victim's bleed injuries have greater chance of preventing hemorrhagic death rather than waiting for first responders to arrive. This study examined the uptake of STB among 117 urban university students located in the Midwestern United States who often feel the pressures of public safety as participants in surrounding city life. Guided by *protection motivation theory* (PMT), we explored how students' *fear of potential mass casualty incidents*, *threat appraisals*, and *efficacy appraisals* related to their *bleed control knowledge acquisition* immediately after completing STB training, as well as *retention* 12 weeks after the training concluded. Results indicated that participation in STB raised students' fears of mass casualty events and self-efficacy. Both factors significantly correlated with bleed control learning outcomes assessed immediately after the STB class; however, they did not predict later retention. We discuss our study's contributions to fear appeals research and PMT theory, before offering recommendations for future hemorrhage control programs, public safety, and prevention research.

Keywords Emergency preparedness · Stop the bleed · Bleed control · Self-efficacy · Fear appeals

Extended author information available on the last page of the article

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Introduction

As more of the world's population begins to migrate toward urban city centers, finding ways to address increasing gun violence, gun homicides, and mass shootings is critical. In the United States, several community health education initiatives have emerged to try and prepare urban citizens to help one another in an emergency. One such innovation developed by the American College of Surgeons (ACS) in 2014 is *Stop the Bleed* (STB; stopthebleed.org, n.d.). Though initially used by the United States military, the current STB campaign is aimed at turning civilians into immediate responders who are able to stop bleeding from all hazards, including active shooter and intentional mass casualty events (Jacobs et al., 2022).

STB teaches laypeople how to treat a victim experiencing life-threatening bleeding with wound packing, pressure application, and effective placement of a tourniquet. The STB curriculum—consisting of a lecture, a hands-on demonstration, and practice session of wound packing and tourniquet application—is built on the premise that bystanders who are properly trained to intervene in an emergency have greater chance of preventing hemorrhagic death rather than waiting for first responders to arrive (Lei et al., 2019). The popularity of STB is evident: ACS touts that over 4 million people have completed STB (stopthebleed.org, n.d.). Yet problems persist—even if people overcome the barriers to initial enrollment and complete the course—they often do not retain enough information to perform life-saving skills in an emergency.

The goal of this study was to examine those factors that affect acquisition and retention of bleed control knowledge among students at an urban university. Urban university students are active within the cities that their campus is situated in and often feel the pressures of public safety—not just as members of their campus community, but also as participants in surrounding city life. Experts have debated whether the benefits of teaching bleed control outweigh the risks of exposing young adults to the threat of traumatic injury, violence, and active and mass shootings—the latter of which has become a leading cause for concern among Generation Z, currently aged 13–28 (Abrams, 2023). Relatedly, prevention researchers have also argued that "greater focus on the benefits and barriers of sharing emergency preparedness information with students is warranted" (Morrow et al., 2024, p. 223).

Guided by *protection motivation theory* (PMT; Rogers, 1975), our study involved students sampled from a public, urban university in the Midwestern United States. We report how students' *fear of mass casualty incidents*, *threat* and *coping appraisals* relate to their *acquisition of bleed control knowledge* immediately after completing STB training, as well as *retention* 12 weeks later. We examine if the increase in fear of mass casualty incidents and self-efficacy experienced as a result of STB training functions as a motivator or hindrance for students' bleed control emergency preparedness.

Emergency Preparedness Through Bleed Control Education

Meta-analyses of STB program evaluation studies suggest that on the whole, it is generally effective in teaching bleed control skills to the lay public. Though most of these studies focus on immediate *skill recall* (post-training execution of bleed control skills; Humar et al., 2020; Tang et al., 2023), the few studies that have assessed longer-term retention report participants' skill recall atrophying in as little as 30 days (Pasley et al., 2018), three to nine months (Goralnick et al., 2018), and a full year after STB training (Fridling et al., 2020). While this past work is helpful, to be more effective, research should assess "the mechanisms that intervene between the delivery of program service and the occurrence of outcomes of interest" (Weiss, 1997, p. 73). We applied *protection motivation theory* (PMT; Rogers, 1975) to uncover key mechanisms, and in doing so also investigate the ongoing debate about the pros and cons associated with exposing young adults to the fear of mass casualty incidents, bleed injuries, and acts of violence for the sake of emergency preparedness and prevention.

Bleed Control for Emerging Adults: The Functionality of Fear and the Implementation of Efficacy

Though civilians of all ages can participate in STB training, our study focuses on the specific population of college-aged students in the urban university campus setting. Most university students aged 18–25 are part of Generation Z and are in a stage of *emerging adulthood* (EA)—a critical developmental phase characterized by less parental/family support and greater independent decision making across a variety of contexts such as education, work, relationships, and finance (Arnett, 2004). The combination of deepening political, environmental, and fiscal uncertainties in recent years have produced markedly difficult conditions for Generation Z's EAs, creating negative trends such as greater financial debt, higher levels of depression and loneliness, and weaker relational connections (Dwyer & DeMarco, 2024); of particular concern is the increasing threat of gun violence that has resulted in EAs' increased levels of psychological stress and hyper-vigilance in public spaces compared to other generations.

Yet prior work has demonstrated that a key factor associated with other, more positive EA outcomes is their sense of optimism or *hope* which can serve as resource that EA draw on in times of stress: "Hope, as a form of personal capital, serves as a priceless asset in the face of adversity" (Bennett et al., 2014, p. 313; see also Arnett, 2004). As hope stems from "a sense of self-efficacy and knowledge of alternate outcomes" (Wood et al., 2018, p. 135), it is possible that STB offers a sense of self-efficacy for EAs that can help them combat the potential threat of mass casualty incidents that carries so much stress.

Across the applied literature, emergency medicine physicians, public health and prevention researchers have all stressed the importance of offering bleed control education to younger populations in the United States, from school-aged children to university students (Freiburger et al., 2021; Katzer et al., 2019; Okereke et al.,

2022). Given that between 2000 and 2019, 82 people were wounded and 75 people were killed in shootings on university and college campuses (FBI, 2021), such calls to action are not unreasonable. Haider et al. (2017) opined in their *JAMA Surgery* editorial:

> We believe that bleeding control initiatives need to be similarly incorporated in high school curricula nationwide. and the Boston Marathon bombing, and they have the potential to be particularly effective (p. 910).Young people are disproportionately affected by intentional mass casualties and active shooter events, as seen by the Pulse nightclub shooting and the Boston Marathon bombing, and they have the potential to be particularly effective (p. 910).

Beyond expert opinion, empirical evidence hints at greater retention of bleed control knowledge among younger participants compared to older ones. In their randomized trial involving 303 individuals, Goralnick et al. (2018) assessed tourniquet application ability three to nine months after a bleed control class. They found that overall, while 54.5% of the sample was able to correctly apply a tourniquet, retention was significantly associated with age, such that younger participants (aged 18–35) were "more likely to be efficacious than those older than 55 years" (Goralnick et al., 2018 , p. 1).

However, those concerned with emergency preparedness trainings like active shooter drills and bleed control classes exacerbating young adults' already heightened fear regarding violent crime raise an important consideration: The American Psychological Association's Stress in America project found two of the most significant sources of stress among its Gen Z participants were the potential of mass shootings and potential of school shootings, with 75% and 72% reporting being concerned about each threat, respectively (Abrams, 2023). In fact, fear of gun violence is so pronounced among college-aged students that simply reading news coverage of a shooting is enough to induce negative emotional reactions among college students (O'Brien & Taku, 2022). Critics cite this as evidence that offering emergency training forces young, impressionable students to confront their vulnerability of encountering a mass casualty event at school, while only providing minimal gains in emergency preparedness (e.g., Miotto & Cogan, 2023).

Though this debate regarding bleed control and active shooter training persists, past reviews indicate that disaster education for younger populations may be worthwhile in other contexts: In their review of the emotional impacts on children and adolescents (aged 18 and younger) of preparedness education for natural disasters such as earthquakes and tsunamis, Johnson et al. (2014) concluded that "overall, most studies concluded that the programs had no significant impact on children's reported level of fear, and in some cases, education appeared to reduce disaster-related fears" (p. 119). Similarly, in their review Midtbust et al. (2018) suggest that rather than totally avoiding the topic of disasters, hazard education should be cautiously offered to children using age-appropriate methods; however they also pointed out that "there is still a dearth of data-based literature in the area" (p. 5). Because the specific psychological and emotional effects of bleed control education on younger participants

have yet to be examined, our study investigated how university students' *fear of crime* and sense of *self-efficacy* may be affected by participating in STB.

Student's Fear of Crime and Communication of Threats in the College Campus Setting

Students' fear of crime is shaped by institutional resources such as police presence, physical layout of campus (lighting, evacuation maps, etc.), public safety plans and policies (Maier & DePrince, 2019). Research also indicates that the unique features of urban universities may contribute to students' fear of crime. Situated in bustling, densely populated metropolitan centers, *urban universities* are responsible for meeting the demands of students, faculty, and staff, and for staying attuned to the culture, needs, and issues of the larger cities they occupy. Hignite et al. (2018) argue that the greater frequency of "crime cues" like darkness, silence, abandoned buildings/physical decay, trash/litter, and disruptive behaviors by panhandlers, intoxicated individuals, or gangs in urban areas can intensify students' fears: "students at urban colleges and universities should exhibit higher perceptions of victimization risk than schools where these crime cues exist less frequently, if at all" (p. 122). Students at urban universities also tend to be wary of the potential for crime to "spillover" from the surrounding city area onto campus, despite limited evidence that this phenomenon truly occurs (Jennings et al., 2007). Individual demographics can also play a role, as fear of crime on urban campuses tends to be greater among female and racially minoritized students (Boatang & Adjekum-Boateng, 2017).

Because campus safety and fear of crime are important concerns among college students, they often serve as *first information responders* during emergencies (Omilion-Hodges & Edwards, 2021). Students are often the first to know about crimes on campus, making them important to crisis communication process. Research indicates that students make judgments about the crisis messages and alerts they receive, and that their perceptions of a source's credibility, communication channel, and severity of the threat (e.g., tornado hazard versus violent crime) affects their willingness to pass along information to others (Omilion-Hodges & Edwards, 2021). For instance, when receiving alerts about violent crimes like a campus shooting, Sheldon (2018) found that compared to broadcast channels like social media or email, college students prefer the efficiency and expediency of word-of-mouth or phone calls to communicate information to others. This evidence suggests that college students deliberate carefully about the messages they receive when presented with hypothetical crisis situations, but it is less clear how they might communicate about prevention programs like STB that are often discussed prior to the occurrence of actual emergencies.

In sum, university campuses tend to be safer than other public spaces on average; yet when violent crimes do occur, because they tend to receive disproportionate media coverage and generate word-of-mouth discussion, students' perceptions of overall crime frequency and personal vulnerability may increase—particularly among those attending colleges located in urban areas. However, we know less about how this fear functions in the STB context, particularly when combined with increased sense of

self-efficacy that bleed control training may provide students. To tease these mechanisms apart, we turned to *protection motivation theory*.

Protection Motivation Theory

First introduced by Rogers in 1975, PMT has been used by researchers to explain and predict people's risk prevention intentions and ensuing behaviors across a wide variety of domains (see Balla & Hagger, 2025; Floyd et al., 2000; Milne et al., 2000; Norman et al., 2015). Similar to other fear-as-drive models, the core proposition of PMT is that fear of an impending threat can inspire people to make recommended behavioral changes in response. PMT proposes that individuals undergo two cognitive appraisals when facing their fear: The *threat appraisal* process consists of individuals' perceptions of the *severity*, or the perceived negative consequences of the threat, and their *likelihood* or *susceptibility* of personally encountering that threat. In the *coping appraisal* process, people evaluate the *response efficacy*, or the effectiveness of a recommended response to that threat, as well as their own *self-efficacy* or their ability to engage in the recommended response. Together, threat and coping appraisals prompt a person's *protection motivation*, which "has the typical characteristics of a motive: it arouses, sustains, and directs activity" (Rogers,1975, p. 98). The concept of protection motivation therefore requires that people fear a threat and also see an adequate way to respond. In this way, PMT stands out by explaining how fear appeals function to impact people's cognition and intention to perform (preventative) health behaviors.

Applying the logic of the PMT model here suggests that university students' fear of a mass casualty event may be (inadvertently) induced during STB, but that they are also taught new information and skills that help them cope with that fear. We expect emotion and efficacy combine to motivate emerging adults to guard themselves from the potential threat of a mass casualty incident on campus by (a) paying greater attention during STB training and (b) retaining the information to protect themselves in the future. However, if—as critics suggest—bleed control training elevates fear by forcing emerging adults to confront the threat of a mass casualty event but is seen as an inadequate response, they may end up either denying the threat's existence or become paralyzed by their fear. Either outcome would then negatively impact their ability to retain bleed control techniques, putting them at even greater risk than if they had never undergone STB training at all.

The Current Study

Questions remain about which factors drive bleed control knowledge and skill acquisition and retention—particularly among emerging adults who comprise an especially anxious generation that worries over the increasingly frequent threat of mass casualty events in public spaces. The heightened fear of crime and violence among students attending college in urban areas suggests that they may be particularly motivated to attend STB training as a way to combat that threat. As past STB studies have

not measured fear explicitly nor examined its relationships to bleed control learning outcomes, we begin with the following research questions and hypotheses aimed at understanding effects on *knowledge acquisition* measured immediately after students complete the STB class:

RQ1 Are university students' fears of mass casualty incidents associated with concurrent bleed control knowledge acquisition after taking the STB training?

Additionally, we explore the PMT-based relationships between threat appraisals, efficacy appraisals, and protection motivation outcomes for the STB training course. We predict generally that (a) people's perceived likelihood and severity of the potential threat of a mass casualty event combine with (b) response efficacy and self-efficacy appraisals of STB as a credible means to deal with that threat. These appraisals should motivate them to attend to and retain key bleed control skills and information for use in a future emergency.

H1 *University students' post-STB (a) threat appraisals (e.g., likelihood, severity) of mass casualty incidents and (b) efficacy appraisals (e.g., response and self-efficacy) of STB are associated with their concurrent acquisition of bleed control knowledge after taking the STB training.*

Additionally, because past work suggests we should expect some decline in recall of bleed control skills, we wanted to know if PMT mechanisms predicted retention three months after completing the STB training. This set of hypotheses is novel in that it directly addresses the ongoing debate about the pros and cons of STB by examining if the increase in emotion, threat, or coping appraisals experienced as a result of taking the STB course helps or hinders students' later retention:

RQ2 Are university students' post-STB fears of mass casualty incidents associated with their subsequent retention of bleed control (a) knowledge and (b) skill 12 weeks after completing the STB training?

H2 *University students' post-STB class (a) threat appraisals (e.g., likelihood, severity) of mass casualty incidents and (b) efficacy appraisals (e.g., response and self-efficacy) of STB are associated with their subsequent retention of bleed control (i) knowledge and (ii) skills 12 weeks after completing the STB training.*

Finally, given college students' propensity to share crisis information as first information responders (Omilion-Hodges & Edwards, 2021; Sheldon, 2018), we were interested in the communication dynamics surrounding STB and whether students discussed bleed control with other people in their lives after completing the training:

RQ3 After participating in STB, do university students talk about bleed control with others?

Method

We tested the above research questions and hypotheses with a sample of students enrolled at a large, urban university located in the midwestern United States. Our sample was recruited from 10 different sections of an introductory-level, general education course in communication and public speaking and participation at all phases was voluntary. An initial group of 188 students indicated interest in the study at recruitment, with 147 students enrolling formally. Between Phase 1 and the final behavioral assessment, overall attrition was 20.4%. Due to this attrition, the sample sizes across each phase of the study varied, with STB and Time 1 posttest, n = 147 students (M_{age} = 18.96, SD_{age} = 1.97; White = 46.3%, non-White = 53.7%; male = 36.7%, nonmale = 62.6%); Time 2 bleed control retention quiz, n = 134 (M_{age} = 19.01, SD_{age} = 2.02; White = 51.5%, non-White = 48.5%; male = 31.9%, nonmale = 66.4%); Time 2 objective behavior assessment, n = 117 students (M_{age} = 19.06, SD_{age} = 2.07; White = 50.4%, non-White = 49.6%; male = 31.4%, nonmale = 68.6%). Our IRB approved all recruitment and study procedures described below. No competing interests are reported by any of the authors.

Procedures and Measurements

Phase 1

After providing their informed consent and completing a basic intake survey of demographic information and baseline fear, threat severity, and likelihood of mass casualties on campus, participants took the *STB training session* during regular class time. The STB trainings were on average 60 min long and consisted of a lecture and a hands-on practice session. Two seasoned instructors with professional expertise in trauma/acute care and emergency medicine taught all STB sessions. They were selected for their extensive experience and knowledge of the STB curriculum, as well as their familiarity in working with the lay public, having collectively taught over 200 STB trainings in and around the city and metropolitan area that surrounds the university (e.g., area K-12 public school staff, community groups, law enforcement/police departments).

Immediately after the STB training, participants completed an *online posttest at time 1*. Following prior PMT work (Milne et al., 2000) participants' *fear*, *perceived severity*, and *personal likelihood/vulnerability* of encountering a mass casualty incident were assessed in this posttest survey. "Mass casualty" was defined for participants as "a major event in which emergency medical resources, equipment and first responder personnel are overwhelmed by the number and severity of injuries and casualties at the scene." Participants' appraisals of STB's *response efficacy* (as a recommended strategy to counter the threat of a mass casualty incident), and their *self-efficacy* (or ability to perform the wound packing, pressure, and tourniquet application skills taught during STB training) were also assessed. In addition, participants' responses to a 5-item, multiple-choice quiz from Daigle et al. (2019) were summed to create the dependent variable of *bleed control knowledge acquisition*. Participants also provided their *basic demographic information* (age, race, sex), their knowledge

of emergency preparedness campus policies, and their overall ratings of the STB course and instructors.

Phase 2

The *time 2* assessment was conducted 12 weeks (approximately three months) after the STB course and consisted of two components to assess knowledge and physical skill retention.[1] Keeping in mind issues of test–retest sensitivity, we administered another 5-item quiz that consisted of different questions from Time 1 (also from Daigle et al., 2019). The Time 2 retention quiz was taken during regular class time, and scores were again summed to create a dependent variable of *bleed control knowledge retention.*

To explore the communication dynamics surrounding bleed control as a public emergency preparedness program, students were asked if they had talked about STB with anyone after finishing the training: "I talked to others in my life about the life-saving bleed control skills I learned in Stop the Bleed." If they answered "yes" to this question, they were asked to name the parties they talked to (friend, family members, coworkers, etc.) and how they did so. The survey closed with a final open-ended question that asked: "Thank you for your participation this semester! Would like to leave any additional comments about the Stop the Bleed training and/or emergency preparedness procedures at our university?"

To measure skill retention, we again followed prior STB research (Chen et al., 2022; Goralnick et al., 2018). The instructors performed an *objective behavioral assessment* for each participant individually. Using a checklist adapted from Schroll et al. (2020), participants were ushered into a separate classroom space and asked one-by-one to demonstrate wound packing on a training mannequin and tourniquet application on the instructor's arm. They received one point for each correct behavior; scores were summed to create the *skill retention* variable. Table 1 shows item wordings and reliability estimates.

Upon completing this Time 2 assessment, participants were thanked and given extra class credit for each phase of the study they completed. Those who completed all phases of the study were given a CAT tourniquet to keep in case of emergency and were entered into a raffle drawing for one of ten, $25 Amazon gift cards (see Table 2 for correlations).

Results

To account for the structure of our data (e.g., students nested within class sections), we began analysis by exploring the "empty" one-way ANOVA model containing no predictor variables, to assess whether there was evidence of variation in the depen-

[1] The 12-week period between Time 1 and 2 was a practical design decision to streamline our data collection procedures and limit them to a single semester. This time period is also consistent with prior evaluative studies of STB that employed longer-term retention assessment (e.g., Chaudhary et al., 2019; Dhillon et al., 2018; Goralnick et al., 2018).

Table 1 Independent and dependent variables and item wordings

Variable	Sample item wording	Response options
Fear	The thought of being in a mass casualty incident makes me feel… Calm—Anxious Not at all afraid—Afraid Neutral—Nervous	1 to 7 *M* = 5.02 *SD* = 1.40 Alpha = 0.88
Severity	If I were to be caught in a mass casualty incident… …I'd consider it to be a serious problem. …It would be extremely dangerous for me. …it would be very bad for me.	1 = strongly disagree 7 = strongly agree *M* = 5.57 *SD* = 1.17 Alpha = 0.75
Likelihood/vulnerability	In considering the potential threat of a mass casualty incident occurring on campus, what would you say your chances are of experiencing one in your own life? I never think about being involved in a mass casualty event—I think about the potential of a mass casualty event all the time I'll never encounter a mass casualty emergency—I'm certain I'll encounter a mass casualty emergency It's extremely unlikely I'll ever experience a mass casualty event—It's very possible I'll experience a mass casualty event	1 to 7 *M* = 4.79 *SD* = 1.24 Alpha = 0.73
Response efficacy	I think the techniques I learned in this bleed control class would… …work to stop a traumatic bleed injury. …could potentially save a person's life in a mass casualty incident. …could potentially save my own life if I were suffering from traumatic bleeding.	1 = strongly disagree 7 = strongly agree *M* = 6.37 *SD* = 0.82 Alpha = 0.81
Self-efficacy	I would be able to perform bleed control methods I learned in Stop the Bleed during an emergency If confronted by a mass casualty incident, I think I could use the strategies I learned in the Stop the Bleed class I would be able to use the techniques I learned in this class to help someone who was bleeding	1 = strongly disagree 7 = strongly agree *M* = 6.23 *SD* = 0.90 Alpha = 0.91
Bleed control knowledge acquisition and retention		
Bleed control quiz questions (Daigle et al., 2019)	What is the first response to a victim who has a bleeding emergency? a. Call 911 b. Find the bleed site/injury c. Make sure the scene is safe	0 = incorrect response 1 = correct response Time 1, *M* = 4.08, *SD* = 0.90 Time 2, *M* = 3.13, *SD* = 1.09
Bleed control skill retention assessment		

Table 1 (continued)

Variable	Sample item wording	Response options
Wound packing and tourniquet application behaviors (Schroll et al., 2020)	• Assesses bleed site • Uses 2 hands • Applies firm and continuous pressure • Packs gauze into open wound • Assesses bleed site/applies above bleed site • Avoids placing tourniquet over elbow joint • Removes slack from tourniquet before tightening windlass • Tightens windlass until bleeding stops or pulse disappears • Locks rod in place with windlass clip • Adheres and secures strap	0 = incorrect/absent 1 = correct *M* = 7.60, *SD* = 1.93

dent variables across class sections (Hayes, 2006). Analyses were conducted with SPSS and R with the LME4 package using maximum likelihood estimation, and we note the sample size used for each analysis. As shown in Table 3, no significant variation in outcomes was detected across class sections, so we proceeded using a pooled regression model for the hypothesis tests reported below.

Immediate Knowledge Acquisition: What Do Students Learn?

Our first regression model examined relationships between fear of mass casualty incidents (RQ1) and the PMT variables of threat likelihood and severity and response and self-efficacy (H1) with students' immediate acquisition of bleed control knowledge after taking the STB training, as reflected in their Time 1 quiz scores. Examination of the regression results indicated significant effects for fear (b = 0.150, p = 0.02) and self-efficacy (b = 0.338, $p < 0.001$) as both were positively associated with students' quiz scores assessed immediately after the STB class. There were no significant relationships with any of the other PMT variables.[2]

Retention of Knowledge and Skills 12 Weeks After Training

We repeated the regression analysis by examining relationships between fear, threat likelihood, threat severity, response and self-efficacy, with students' quiz scores that measured their bleed control knowledge retention 12 weeks after taking the STB training. The prior association between fear and bleed control knowledge acquisition seen at Time 1 dissipated, indicating that fear of mass casualty events did not predict later knowledge retention. Similarly, the significant positive effect of self-efficacy on knowledge acquisition at Time 1 dissipated at Time 2. This suggests that taking the STB training may create bursts of fear and self-efficacy that do not last over time.

[2] We acknowledge the significant effect of semester in these analyses, with students in Fall semester showing stronger immediate acquisition of bleed control knowledge immediately after the STB training compared to those in the Winter semester. A binomial test of proportions indicated that attrition rate for fall semester (19.35%) did not differ significantly from winter semester attrition (22.22%), Z = −0.36, p = 0.07. We controlled for this effect statistically and focus on the specific factors involved in the PMT framework.

Table 2 Study correlations

Variable	1	2	3	4	5	6	7	8	9	10
1. Fear	–									
2. Threat likelihood	0.262**	–								
3. Threat severity	0.298**	−0.037	–							
4. Response efficacy	0.046	−0.042	0.281**	–						
5. Self efficacy	−0.082	−0.061	−0.002	0.368**	–					
6. Knowledge acquisition (Time 1 quiz)	0.095	−0.116	−0.044	0.023	0.343**	–				
7. Knowledge retention (Time 2 quiz)	0.015	−0.073	0.010	0.045	0.152	0.341**	–			
8. Skill retention	−0.062	0.164	−0.010	0.005	0.092	0.250**	0.110	–		
9. Race	−0.019	−0.008	−0.088	0.029	0.255**	0.200*	0.344**	0.202*	–	
10. Sex	−0.437**	−0.234*	−0.018	0.044	−0.007	−0.009	0.042	−0.128	0.024	–
11. Age	−0.088	−0.122	−0.004	0.147	0.053	0.170	0.058	0.039	0.074	−0.038

$n = 117$. *$p < 0.05$; **$p < 0.01$. Race, 0 = “non-White” 1 = “White”; Sex, 0 = “non male” 1 = “male”.

Regarding RQ2b and H2ii with respect to wound packing and tourniquet application skills, no significant relationships emerged. Despite not finding support for the predictive power of PMT on retention, we note that our study still offers important contributions for the larger body of PMT research, as most prior studies tend to examine intentions to perform health behaviors rather than actual behavioral performances, and even fewer involve outcome measures over time (Boss et al., 2015; Milne et al., 2000). We return to this in the discussion section (see Table 4 for a summary of regression analyses).

Communication About STB and Bleed Control Education

Regarding RQ3, we found $n = 94$ (approximately 80%) of the sample reported talking about STB with someone they knew after completing the training. Closer analysis of the follow-up question that asked them to name the various parties that they engaged in discussion revealed that most talked with immediate family members ($n = 37$), friends/roommates ($n = 29$), classmates ($n = 9$), coworkers ($n = 4$) and romantic partners ($n = 3$) about STB.

Interestingly, the CAT tourniquet became a way for students to introduce the concepts of bleed control and bystander intervention to others, and to explain what STB is in more depth: "The day that I received my tourniquet I showed my mom and told her what is, why I have it and what Stop the Bleed is." Another participant elaborated: "I talked to my parents and a few classmates about the program when I told them 'oh yeah! I carry everything from bandaids to a tourniquet.' And they would ask why a tourney, so I would explain the program and why it's important now than ever to have at least a little emergency first aid knowledge." Some students also mentioned that they encouraged others to enroll in STB and learn bleed control techniques for themselves: "I talked to my family and close friends about it, and I encouraged them to do it." Regarding RQ3, most students felt comfortable—even excited—about sharing bleed control information with others in their networks.

Discussion

Using protection motivation theory (PMT), this study explored how fear and threat and coping appraisal processes experienced immediately after taking the STB course might explain individual variation in bleed control learning outcomes and subsequent retention. Below, we discuss how our findings pertain to fear appeals research and PMT theory and public safety in urban universities. We also discuss the limitations of this study and offer practical improvements to the STB program.

STB as a Fear Appeal: Motivation and Retention

The central question this study sought to answer was whether STB's function as a fear appeal would overwhelm college students (as critics contend), or if teaching them bleed control techniques would help them cope with the threat of mass casualty incidents (as advocates hope). We found that both were true—at least in the short-

Table 3 Parameter estimates for null model

Effects	Bleed control knowledge acquisition (Quiz score, time 1)	Bleed control knowledge retention (Quiz score, time 2)	Skill retention (Behavioral assessment, time 2)
Intercept	4.09**	3.15**	7.45**
Class Section	0.18	0.004	0.000063
Individual	0.79**	1.15**	3.96**
Sample Size	147	134	117

*$p<0.05$; **$p<0.01$.

Table 4 Fear, threat appraisals, and efficacy appraisals on bleed control knowledge acquisition and knowledge and skill retention

	Bleed control knowledge acquisition (Quiz score, time 1) $n=147$	Bleed control knowledge retention (Quiz score, time 2) $n=134$	Bleed control skill retention (Behavioral assessment time 2) $n=117$
(Intercept)	0.801 (1.008)	1.823 (1.424)	5.523* (2.684)
Fear	0.150** (0.057)	0.065 (0.078)	− 0.276 (0.151)
Likelihood	− 0.104 (0.058)	− 0.072 (0.077)	0.284 (0.150)
Severity	− 0.054 (0.065)	0.009 (0.087)	0.174 (0.172)
Response Efficacy	− 0.143 (0.101)	− 0.016 (0.139)	− 0.083 (0.277)
Self-Efficacy	0.338** (0.087)	0.077 (0.118)	0.056 (0.230)
Control Variables			
Semester	0.339* (0.146)	0.095 (0.199)	− 0.974 (1.053)
Sex	0.076 (0.159)	0.106 (0.220)	− 0.830 (0.444)
Race	0.042 (0.141)	0.612** (0.192)	0.825* (0.375)
Age	0.087* (0.036)	0.031 (0.048)	0.045 (0.090)
Model Fit			
R^2	0.225	0.115	0.184
Adjusted R^2	0.173	0.051	0.04
AIC	359.6	389.0	500.2
BIC	392.3	420.4	552.6
Log likelihood	− 168.81	− 183.48	− 231.08
RMSE	0.78	1.00	1.74

*$p<0.05$, **$p<0.01$. Semester, 0 = "Winter 2023" 1 = "Fall 2023"; Race, 0 = "non-White" 1 = "White"; Sex, 0 = "non male" 1 = "male"

term. Taken together, our findings suggest that while STB may heighten students' fear of the threat of mass casualty incidents, it also boosts self-efficacy as evidenced by the significant association of both factors with the quiz scores used to assess students' immediate, post-STB learning. Boss et al. (2015) point out that this is the dual function of the fear appeal message as a stimulus that not only induces the negative emotion of fear (in response to a threat judged as dangerous) but that also increases efficacy by "giving a respondent a path to address the threat" (p. 8).

However, we also saw that the increases in fear and self-efficacy reported by students immediately after taking the STB training were short lived, as neither was significantly associated with students' knowledge or behavioral skill retention assessed 12 weeks later. Had we focused solely on immediate post-STB outcomes, we may

have been tempted to conclude that we had robust support for the PMT model because our results replicated patterns seen in prior work. But because we measured longer-term retention outcomes, we are more cautious, instead concluding that the effects of these initial increases seem to wane with time.

Contributions to PMT and STB Research

The null effect of threat appraisals and the significant effects of coping appraisals seen in our study are consistent with prior reviews of published PMT research that report threat appraisal effect sizes to be much smaller than those of coping appraisals (Balla & Hagger, 2025; Milne et al., 2000). Our results further contribute to prevention research by replicating and extending PMT's predictive power into the novel context of bleed control. Our focus on longer-term retention outcomes also adds to PMT and bleed control research areas, both of which have focused primarily on participants' immediate (i.e., post-intervention) perceptions, intentions, and behaviors as the main outcomes of interest.

Additionally, despite its long history, much PMT-based work has examined only participants' *behavioral intentions* rather than *actual behavior*: In Floyd et al.'s (2000) meta-analysis, of the 65 PMT studies reviewed they found only 22 that examined actual behaviors. Even fewer published PMT tend to focus on *future* behavior; in the 27 studies included in Milne et al.'s (2000) meta-analysis, only seven took a longitudinal approach to measure the relationships between PMT variables and participants' future behaviors. Given the differential short- and long-term effects of fear and self-efficacy found in our results, we highlight the importance of designing applied studies that explore how threat and coping mechanisms affect individuals' concurrent and future behaviors when feasible. The risks of not doing so include overstating the ability of the PMT to explain and predict people's subsequent behavior (see also Balla & Hagger, 2025).

Practical Recommendations for STB and Emergency Preparedness and Prevention Programs in Urban Universities

Even though they did not persist longitudinally, the relationships among students' fear, self-efficacy, and initial learning outcomes are noteworthy. Marked increase in post-STB self-efficacy (i.e., willingness/confidence to help others in an emergency) is a finding that shows up routinely in bleed control program evaluation studies and was replicated again here (Elkbuli et al., 2019; Okereke et al., 2022). Although almost all these prior STB studies have focused on self-efficacy as an outcome in itself, ours was one of the first studies to measure participants' post-training fear and self-efficacy levels and test associations with their bleed control learning and retention. In light of these findings, we recommend that the STB lecture be revised to emphasize both the importance of bystander intervention during scary events, as well as individual self-efficacy.

We found the current retention rates to be similar to prior STB evaluations (e.g., Goralnick et al., 2018; see also Humar et al., 2020 & Tang et al., 2023); and though we suspect that these findings would generalize beyond college students, we recom-

mend more investigation into the psychological effects of STB among the general public. There is some evidence that college students develop and experience fear of crime uniquely—the extensive media coverage of university shootings often heightens students' fears that similar events will occur on their own campuses, which might make them feel especially vulnerable. For instance, Kaminski et al. (2010) found that in the wake of the highly publicized shootings at Virginia Tech and Northern Illinois University, students at the University of South Carolina felt greater fear of being a victim of violent crime on their own campus. Heightened risk perceptions can influence college students' receptivity to prevention efforts in ways that might make them different from the general public, which is a direction for future research.

We also encourage STB trainers to remind their students of the importance and power of practicing and reviewing their newly acquired skills. To our knowledge, continuing education is not stressed in the current STB campaign despite recommendations for refresher material (Nichols & Horstman, 2022). Video tutorials, posters, and other resources are available online (stopthebleed.org, n.d.); however, few civilians are likely to view this material unless prompted. Past campaigns engaging lay audiences in bleed control education through social media have proven successful (Fisher et al., 2019), and similar translational communication strategies could be adopted by schools and universities to build a sense of community among the student body and boost their emergency preparedness at the same time.

Student Participant's STB Program Recommendations

Finally, we note that students in this sample were generally positive about participating in STB. Examination of participants' final open-ended feedback regarding their experience indicated an overwhelmingly encouraging response: "It was [a] really good class. Very informative and interesting. It's good that this program exists because it informs and teach[es] people. I loved it. 10/10." Others directly mentioned the boost in self-efficacy they felt after taking STB: "After this training, I feel more confident in my abilities to help in a mass-casualty incident and am less anxious about said events." This was true even among those who had prior experience with school shootings: "I think this course was very helpful in knowing what to do in a situation where someone is bleeding. As someone who has been thru [sic] a school shooting, I think it is very important for everyone to know what to do in a situation like that." No participants ever withdrew from the study formally, and none expressed any regrets about enrolling in the STB training. At least among this sample of college-aged students, the pros of STB seemed to outweigh the cons, with most finding their new bleed control skills to be beneficial. Some participants offered specific ideas on how to improve the course with the most common suggestion to have "a bit more hands-on practice." Another suggested greater focus on wound packing: "maybe taking more time to practice wound packing would be important also, just because it's unlikely to have a tourniquet at hand." A few also asked if bleed control information or materials would be offered to other students beyond those who were involved in the current study: "Will there be Stop the Bleed station implemented on campus?" Students took the training seriously and willingly and enthusiastically embraced their role in the crisis communication process by considering how they could involve their

peers across campus to boost public safety overall. Students' general receptiveness implies that peer-led refreshers or interventions could be relevant to the STB program in the future. Indeed, rather than continuing to promote individual self-efficacy, future efforts might emphasize social capital through a community-based resilience approach (Aldrich & Meyer, 2015), which presents an opportunity to offer prevention skills in a way that meets the emotional needs of a generation that is increasingly fearful of acts of public violence. Future efforts to tailor the STB curriculum to younger audiences could draw from the robust literature aimed at increasing college students' bystander motivations in other relevant prevention domains such as sexual assault, interpersonal violence, and risky alcohol consumption (Humar et al., 2020).

Limitations, Extensions, and Future Directions

Although a significant body of work has examined individuals' retention and feelings of preparedness and self-efficacy more generally, the impact of these factors on individuals' actual behavior in emergency scenarios remains largely unknown. This is a limitation inherent in much emergency preparedness and prevention research, as campaigns themselves are inherently reactive—that is, bleed control skill and knowledge only become relevant once a crisis occurs. Ours is further limited in that it was a single-site study, though we speculate that our results would be relevant to similar urban campus settings. Future replications of this study could be conducted on campuses that vary in student body demographics and environment (e.g., urban vs. residential; prior experience with physical trauma, acts of public violence) and could also assess STB outcomes beyond the 12-week mark, or with follow-up training, to explore how such factors influence psychological response and bleed control retention.

Although initial post-STB learning outcomes were similar across all groups, it appears that White students' later retention was better than students from racially minoritized backgrounds. Survey data gathered from within the United States indicate that compared to White students, racially minoritized students are more fearful of crime on college campuses (Boateng & Adjekum-Boateng, 2017). Additionally, literature also points out broader trends in which White students tend to have greater feelings of psychological flexibility and self-efficacy in higher education settings compared to racially minoritized students (e.g., Schuyler et al.,2021). A post-hoc analysis revealed no significant differences in fear of mass casualty incidents by race but did indicate that White students in this sample reported significantly higher post-STB bleed control self-efficacy than racially minoritized students ($b = 0.339$, $p = 0.02$). We suspect that the differential self-efficacy between White and racially minoritized students may be affecting longer-term retention. As race/ethnicity has been shown to vary across behavioral intentions and actual behavior in disaster prevention contexts within the PMT (e.g., Ma et al., 2024), it is worth examining if such differences also exist in bleed control. Consistent with our prior recommendation regarding message tailoring, variations of the STB curriculum could be developed to reach subpopulations living in different regions of the United States. Cultural and racial-ethnic differences in regional healthcare access, crime rates, and trust in law enforcement and first responders may affect prevention efforts, and culturally-sensi-

tive tailoring may have a greater impact than we realize (see also Nichols & Horstman, 2022). To our knowledge, ethnicity and race have not been studied as factors in STB program evaluation work.

Our convenience sample restricts the conclusions we can draw; however, future studies might explore efficacy and threat appraisals in more granular detail—such as risk perceptions and/or direct experience with various mass casualty incidents (i.e., gun violence versus car crashes). Doing so would allow us to see if generalized risk perceptions or individual past experiences are related to coping appraisals and behavioral outcomes (e.g., Wallace, 2021). Finally, as with all self-report surveys, our variables (though adapted from prior survey work), likely contain measurement error. The nuance involved with operationalizing the PMT is a limitation of this study much like others that rely on the model (Norman et al., 2015). Refining measurement is another avenue for prevention research that strives for a theory-based approach.

Conclusion

Given Generation Z's outsized risk perceptions of gun violence and mass casualty incidents in public, urban settings, it is imperative that the current emerging adult population be offered some way to cope with their ongoing fear. Our study suggests that programs like STB may fulfill that need, but only if participants feel empowered and able to use their bleed control skills in an emergency. In helping them acquire lifesaving skills, we also help this generation of young adults address their fears.

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Authors and Affiliations

Stephanie Tom Tong[1] · Kirby Phillips[1] · Joseph Gomez[2] · Damon Gorelick[3] · Matthew Seeger[1]

✉ Stephanie Tom Tong
stephanie.tong@wayne.edu

[1] Department of Communication, Wayne State University, 906 W. Warren Ave., 585 Manoogian Hall, Detroit, MI, USA

[2] Corewell Health Beaumont Troy Hospital, Troy, MI, USA

[3] Detroit East Medical Control Authority, Detroit, MI, USA