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Wait for backup or not? How police officers view their role when responding to an active shooter event

M. Hunter Martaindale[1] · **William L. Sandel**[2] · **J. Pete Blair**[1]

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Abstract

Objectives Test whether current law enforcement officers believe that they should immediately enter an active shooter scene before waiting on additional officers.

Methods Quasi-experimental vignette design with random assignment to 10 vignettes from a universe of 324. The sample consisted of 796 current law enforcement officers from 43 states, which responded to a total of 7394 vignettes. This report utilized a mixed effects logistic model to assess the appropriateness of the hypothetical officer's actions in responding to an active shooter event.

Results Respondents were between 14 and 80 times more likely to agree with the hypothetical officer's decision to immediately enter an active shooter scene when a driving force was present (i.e., ongoing gunfire or injured victims). This agreement varied across models as we explore different interaction effects.

Conclusions Law enforcement agree with the public sentiment that officers should immediately enter active shooter locations if there is an ongoing threat.

Keywords Driving force · Law enforcement · Police · Active shooter · Vignette

Introduction

Active shooter events have captured the public's attention for some time now. What is clear from public response is that police officers are expected to quickly enter attack locations and stop the shooter when an attack is ongoing. For example, the recent active shooter event at The Covent School in Nashville, TN, was widely heralded as an example of effective police response. During that event, a team of police officers quickly entered the building and began to systematically search for the attacker. When gunfire was heard coming from the second floor, the officers quickly

✉ M. Hunter Martaindale
Hunter.Martaindale@txstate.edu

[1] Texas State University, 601 University Drive, San Marcos, TX 78666, USA

[2] Missouri State University, Springfield, MO, USA

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moved to the second floor and engaged the shooter, ending the attack. Whereas the police response at Robb Elementary School in Uvalde, TX, where it took officers more than an hour to engage the shooter after initially pursuing him in the building and hearing gunfire, has been widely criticized. Despite the clear public expectation for officers to enter active attack locations (Guerrero, 2022; Russell, 2023), only a single study has explored police officer's views on their responsibility to enter an attack location (Phillips, 2020). This paper seeks to expand our understanding of how police officers view their role during active shooter events though the use of factorial surveys.

Literature review

Phillips (2020) identified that one of the central issues in how officers view active shooter response is the tension between the safety culture of policing and the public expectation that officers move to quickly stop active shooters. Both Crank (2014) and Herbert (1998) have clearly identified that officer safety is a primary cultural dimension that dominates officer training, expectations, and thinking.

Active shooter response is inherently dangerous for the responding officers. In their review of active shooter incidents from 2000 to 2018, Blair and Duron (2022) found that a police officer was shot when responding in about 1 out of every 8 (12%) of active shooter events. They argued that this makes active shooter response the most dangerous call in all law enforcement. This finding, combined with a general safety culture, would suggest that officers would be hesitant to enter the location of an active shooter event.

At the same time, bravery is also part of the police culture (Herbert, 1998). Police officers are expected to protect the public. Officers are sometimes expected to use force to protect the public and the use of force means assuming some level of risk (Bittner, 1970; Manning, 1980). This expectation clearly carries over to both active shooter training and policy. In their review of the evolution of active shooter training since the Columbine High School shooting in 1999, Martaindale and Blair (2019) argued that officers (even solo officers) are now expected to quickly enter locations where an attack is occurring and stop the shooter. The current International Chiefs of Police (IACP) model policy also reinforced the need for officers (even solo officers) to act quickly to stop active shooters (IACP, 2018).

To examine how this tension between the safety culture of policing and the expectations of the public, trainers, and policy played out in officers' views, their role in responding to active events, Phillips (2020) conducted a quasi-experimental vignette study. In these vignettes, the participants (a convenience sample of 469 police officers from Texas and New York) were asked to judge their agreement with the actions of a police officer during a hypothetical active shooter scenario. These scenarios varied in terms of the location of the event, number of officers, and how they were equipped, whether 2 gunshots were heard when the officer(s) arrived at the scene or no gunshots were heard, and the action of the officer (wait for backup, ask victims for information, call for the SWAT team, or immediately enter). Each participant made a judgment of a single scenario for a total of 469 observations.

Phillip's analysis of the results using ordinal regression analysis found that only the gunshots heard and officer action variables were significant determinates of the participant's judgments of the acceptability of the officer's actions. Participants generally agreed with the officer's actions when gunfire was heard or when the officer took actions other than immediately entering the building.

Phillips (2020) argued that these results suggest that the safety culture of policing dominated bravery expectations. He argued that simply providing some training and changing policy was simply not enough to make officers disregard safety concerns and immediately move to stop an active shooter. He further argued that his results showed that officers simply did not agree that a responding officer should immediately enter an active shooter event.

Phillips also noted several limitations of his study. Perhaps the most salient being that the scenarios that were presented may have failed to present a clear "driving force" to the officers suggesting that immediate entry to stop the killing was required. Indeed, as Phillips recognized, current training does not instruct officers to run into any "active shooter" situation that is broadcast on the radio (Martaindale & Blair, 2019). Rather, officers must assess the situation before determining that immediate intervention is needed.

The concept of driving force must also be connected to the priority of life scale that is also commonly taught to police. For several years, officers have been taught that the lives of innocent civilians are at the top of the priority of life scale. Under this is the life of the officer, and last is the life of the suspect (Federal Bureau of Investigation, 2020). This scale is used to indicate that officers are expected to assume risk only when the life of an innocent person is at stake. It is the "driving force" that indicates that the lives of innocent people are at stake. Ongoing gunfire is perhaps the clearest driving force. Injured people can be another (as Phillip's notes), but if there are not indications of ongoing violence, it can also be an indicator that the officer should provide aid rather than rush into the building. In the absence of a clear driving force, officers are taught to slow down and investigate what is happening. Because it is not clear that people are being harmed, the safety of the officer is paramount. Thus, the participants in Phillips study may have made their judgements in a way what was completely in line with contemporary training. That is, there was a lack of a clear driving force and therefore options other than immediate entry were generally considered more acceptable. The current study will attempt to address this shortcoming by including a variable that has a clear driving force.

Methods

Vignette design

There are a number of benefits to using a factorial survey when assessing individual perceptions (Sandel, 2019; Wallander, 2009). Some of these benefits include examining influential factors that respondents are unaware of, looking at the context that affects perceptions, and decreasing the tendency for socially desirable answers (Wallander, 2009). Factorial surveys use vignettes, which are short stories or scenarios

where researchers can vary the factors being examined while keeping other aspects of the situation static (Auspurg & Hinz, 2014; Sandel, 2019). Each independent variable presented in the scenario will have a set number of levels. The number of each of these independent variable levels is multiplied together to get the total possible number of vignettes or the vignette universe (Sandel, 2019). For example, one variable may be the amount of money taken in a robbery scenario. The levels might include <$500, $500–1000, and >$1000. Another variable might be the type of weapon that a suspect had. This could be a no weapon, a knife, or a gun. Using this example, one would multiply the three levels of money taken by the three levels of weapon type, or 3×3. This would result in the vignette universe being 9, which is the total number of possible vignettes.

The vignette used in this study was built on Phillips' (2020) vignette by incorporating his identified limitations as well as common aspects of active shooter events as evidenced by the FBI's active shooter reports (FBI, 2019, 2020, 2021, 2022, 2023). For instance, the FBI active shooter reports indicate that the most commonly attacked location is a place of commerce (Martaindale et al., 2017). For this reason, the first factor includes three different types of commerce locations varied by max occupancy (i.e., convenience store, grocery store, large mall). We modified the second factor from the Phillips study. Understanding that officers will respond from their own perspective and that some agencies use single or dual officer patrol units, the second factor simply varies by the type of officer weapon (i.e., a unit with a pistol or a unit with a pistol and rifle). This allowed participants to respond from their personal perspective with zero regard to if they use single or dual officer patrol units. The third factor included three levels for backup response time (i.e., < 2 min, 2–5 min, > 5 min). The average response time for an active shooter event is 3–4 min. This factor provided respondents with a fast, average, and slower than average option. The fourth factor modified a constant from Phillips study and began incorporating varying levels of driving force by describing the scene (i.e., normal, chaotic with fleeing people, chaotic with wounded/bleeding victims). The fifth factor again modified Phillips vignette and further incorporated driving force. Instead of presenting the respondent with "two apparent gunshots" or no statement at all, the fifth factor presented a clearer explanation of the scene on two levels (i.e., continuous, rapid gunfire, or no gunfire heard). For the sixth factor, we slightly modified the officer decision from what Phillips presented (i.e., wait for backup before entering, establish perimeter and wait for SWAT, or immediately enter). The multiple factor levels of our vignette ($3 \times 2 \times 3 \times 3 \times 2 \times 3$) created a universe of 324 possible vignettes. A complete vignette including all factor levels is presented in Appendix 1.

Instead of being presented with a single vignette like in Phillips study, participants were presented with 10 randomly selected vignettes from the universe. The survey was distributed via Qualtrics. Qualtrics allows for vignette randomization without replacement. This ensured that each possible vignette was randomly presented to respondents in groups of 10 prior to starting over. This manuscript utilizes this vignette to test the following primary hypothesis:

H_1: Police officers will prefer the first responding unit to immediately enter the active shooter attack location when a driving force is present.

Data

Dependent variable The dependent variable was a self-reported measure of how appropriate the officer's action was in each vignette. Specifically, respondents were asked: How appropriate was the officer's choice in this situation? Respondents utilized a sliding scale from 0 (not at all appropriate) to 10 (completely appropriate) accurate to the hundredths. Participants were told to respond with their personal opinion independent of their agency's active shooter policies (if their agency had an active shooter policy). We also asked respondents: What would you have done in this situation? Respondents were then presented with the same three response options as presented in the vignette (e.g., wait for additional officers, establish a perimeter and wait for a SWAT team, enter the building without waiting for additional officers).

Independent variables The independent variables consist of respondent demographic control variables (see Table 1) and the factors present in the vignettes (as described above). The factors in the vignette are all dummy coded as present (1) or absent (0), and each is represented in the overall universe of 324 vignettes.

Sample A national law enforcement training provider (The ALERRT Center at Texas State University) agreed to distribute a survey solicitation to a randomly selected group of prior attendees. The solicitation was sent to 7000 randomly selected law enforcement officers' emails in Fall 2021. The solicitation informed participants that they would read 10 "short stories" related to active shooter events and answer two questions after each one. They were provided a link to the Qualtrics survey, and all responses were anonymized. In total, 796 respondents from 43 states participated in the study. Because each respondent was presented with 10 vignettes, a total of 7394 vignettes received a response to the dependent variable. Respondents were able to leave the survey early if they chose. While most respondents completed all 10 randomly assigned

Table 1 Respondent demographics and agency information

	n	Percent		*n*	Percent
Sex			Agency Size		
Male	717	90.19%	Small	417	52.39%
Female	72	9.06%	Medium	181	22.74%
Prefer not to say	6	0.75%	Large	198	24.87%
Race			Agency Type		
African-American	44	5.53%	Police department	414	52.01%
Caucasian	618	77.64%	Sheriff's office	183	22.99%
Latino	84	10.55%	State law enforcement	106	13.32%
Other	50	6.28%	All other	93	11.68%
Rank			Active Shooter Policy		
Supervisor	381	48.11%	Yes	561	70.65%
Non-supervisor	411	51.89%	No	145	18.26%
			Unsure	88	11.08%

vignettes, some did choose to terminate participation prior to completion resulting in the number of completed vignettes. Each of the 324 vignettes was responded to an average of 22.82 times. Table 1 provides descriptive data for respondents.

As seen in Table 1, the sample consisted of law enforcement officers representing a wide range of agencies, job types, and locales. The majority of respondents were male (90.19%), Caucasian (77.64%), worked for a local (small [< 101 officers per Phillips, 2020], 52.39%) police department or sheriff's office (75.00%), were not supervisors (51.89%), and had an agency-wide active shooter policy (70.65%). The average age of respondents was 44.4 years old (SD = 9.85).

Analytic technique

Recall that 10 vignettes were randomly assigned to each participant, resulting in nested data. To complete the analysis, we utilized a mixed effects logistic model where the nesting could be controlled for making the vignettes level one and the participants level two (Sandel, 2019). First, an exploratory analysis was used to determine whether multilevel modeling was appropriate (see notes at end of the manuscript for relevant equations). Controlling for this clustering makes the significance test unbiased and provides more efficient coefficients (Goldstein, 2011; Nezlek, 2001). The dependent variable was converted from a scale to a dichotomous variable where any response below a 5 on the sliding scale was considered a 0 or disapproval of the officer's actions. Anything that was a 5 or above was considered approval of the officer's actions and was coded as a 1. The multilevel logistic models control for the clustered nature of the data while providing odds ratios that can be interpreted as the odds of a participant saying "yes" they thought the officer's actions were appropriate (Sandel, 2019).

Results

As seen on Table 2, we present the mixed effect logistic model with the demographic variables, vignette factors, and two interaction terms present. The interaction terms examine the perceived appropriateness of the officer's decision in conjunction with two forms of driving force (i.e., gunfire and victim actions at the scene). While Table 2 highlights the complete model with both interaction terms, we have included the models without both interaction terms in Appendix 2 to provide readers with a complete view of the data.

Table 2 showcases that officers overwhelmingly believe immediately entering the scene when gunfire was present was the appropriate response when holding all other factors constant. In fact, they were approximately 80 times more likely to believe that the responding unit acted appropriately if they immediately entered the scene when gunfire was present as opposed to waiting for backup or setting a perimeter. Additionally, respondents indicated that they did not think waiting for backup was appropriate when active gunfire was present (44% less odds of agreeing with the responding

Table 2 The mixed effect logistic model with the demographic variables, vignette factors, and two interaction terms

	Odds ratio	SE
Department size (small)		
Medium	0.90	0.12
Large	1.22	0.16
Age	1.00	0.01
Supervisor (no)		
Yes	0.78*	0.08
Active shooter policy (no)		
Unsure	1.04	0.21
Yes	1.00	0.14
Race (white)		
NonWhite	1.07	0.14
Patrol officer (no)		
Yes	1.16	0.12
Attack location (convenience store [< 20 people])		
Grocery store (21–500 people)	0.90	0.07
Mall (501–5000 people)	0.96	0.08
Unit type (pistol)		
Pistol and rifle	0.95	0.06
Time for backup (<2 minutes)		
2–5 minutes	1.01	0.08
> 5 minutes	1.03	0.08
Scene (calm)		
Chaotic w/ people fleeing	0.63**	0.09
Chaotic w/ wounded and bleeding fleeing	0.59***	0.08
Gunfire (no gunfire)		
Rapid gunfire	0.12***	0.02
Officer decision (set perimeter)		
Wait for backup	4.13***	0.63
Immediately enter	1.49**	0.22
Decision * gunfire		
Wait for backup * rapid gunfire	0.56***	0.09
Immediately enter * rapid gunfire	80.30***	15.13
Decision * scene		
Wait for backup * chaotic people fleeing	0.81	0.16
Wait for backup * chaotic wounded and bleeding fleeing	0.65*	0.13
Immediately enter * chaotic people fleeing	2.15***	0.42
Immediately enter * chaotic wounded and bleeding fleeing	2.94***	0.59
AIC	7093.48	
BIC	7272.88	

Reference groups in parentheses

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

unit's actions). This was also true when examining the interaction of the officer's decision to immediately enter the attack location when the scene was chaotic upon arrival. Respondents believed that the responding units' decision to enter the scene was appropriate when the scene indicated some level of driving force with the presence of people fleeing or wounded and bleeding people fleeing the scene (approximately two and three times more likely to agree with the decision, respectively).

Recall that respondents also responded to the following question: What would you have done in this situation? Because the model presented above indicates the strong relationship between the presence of active gunfire and the response decision, Table 3 presents a simple contingency table differentiating vignettes with and without the presence of rapid gunfire based on respondents' answer to what they would have done.

As seen, respondents are more than twice as likely to respond that they would immediately enter the scene if they heard gunfire, even though approximately 12% still indicated that they would wait for backup ($x^2 = 1730.90$, $p < .001$, Cramer's $V = 0.48$). However, respondents were slightly more likely to report waiting for backup to arrive before entering the scene if there was no gunfire present, while few indicated that they would establish a perimeter even if no gunfire was heard from the attack location.

Discussion

The public clearly expects police officers to intervene quickly to stop active shooters. Current training and policy also clearly expect officers to quickly intervene when an active shooter event is occurring. Yet, little research to date has explored what officers think about their responsibilities during these events. This paper showcased how current law enforcement officers across the nation view their role in responding to an active shooter event. Specifically, we found that officers believed that law enforcement should immediately enter an active shooter attack location without waiting for backup if there is a clear driving force present, such as the presence of gunfire or a chaotic scene with or without wounded victims (see Table 2). This is an important finding on multiple fronts. First, it appears that the public expects law enforcement to enter an active shooter event to save lives. For instance, although he was recently found not guilty, the officer that failed to enter the 2018 attack location at Margorie Stoneman Douglas Highschool in Parkland, FL, faced criminal trial for his decision not to enter the scene. Furthermore, there have been multiple law enforcement officers terminated following the attack at Robb Elementary School in Uvalde, TX, and there was significant public outcry regarding the law enforcement response following this attack. This study shows that law enforcement officers are overwhelmingly in line with public expectations' position.

Table 3 Contingency table of respondents' preferred action when gunfire was present

	Rapid gunfire	No gunfire
Establish perimeter	69	246
Wait for backup	379	1885
Immediately enter	3260	1524

Second, these findings suggest that officers, consistent with the priority of life scale that is currently taught, may be willing to assume personal risk to prevent further violence and save lives. This is counter to what Phillips (2020) concluded. While there are several possible explanations for this difference, we believe that the primary one is how we constructed our vignettes. Phillips (2020) indicated that his scenarios may have lacked an adequate driving force to spur the expectation of immediate entry. Drawing from current training that emphasizes a priority of life scale that places innocent people at the top, officers in the middle, and suspects at the bottom and requires a driving force suggesting that innocent people are at risk before and officer assumes risk, we included independent variables that we thought would clearly establish a driving force. Our results suggested that the responding officers were very attuned to the driving force and approved much more of hypothetical officer responses when they immediately made entry in the presence of a driving force. Thus, it appears that Phillips was correct in that his scenarios lacked an adequate driving force to trigger an expectation of immediate entry.

Interestingly, the data presented in Table 3 further showcase that officers personally believe that they should be immediately entering the attack location when there is a clear driving force (i.e., the presence of gunfire). When that driving force was not present in the vignette, officers were more likely to indicate that they would personally wait for backup before entering the scene. This intuitively makes sense. If there is no obvious reason to immediately enter the scene, it is understandable to wait for additional support and take a slower approach. It is worth noting that while the majority reported they would immediately enter when gunfire was present, approximately 12% of officers stated they would not immediately enter the scene when there was active gunfire.

Taken together, these results are in line with modern active shooter response policies in that officers are expected to deal with an active shooter quickly (see IACP Active Shooter Model Policy, 2018). As noted in the literature review, modern active shooter training programs also suggest that first responders operate based on the current driving force (Martaindale & Blair, 2019). The driving force is situationally dependent and can shift based on what is currently happening at the attack location. For instance, if an officer arrives on scene and moves toward the sounds of active gunfire, she is acting on the current driving force. Once she has neutralized the threat, her driving force shifts. If there are wounded people, she should now provide medical care in order to, hopefully, stop some victims from succumbing to their wounds. We believe that the results from this study support this concept of driving force. Furthermore, these results suggest that officer beliefs line up with public expectations. Given the scrutiny that police currently face, it is good to see at least one area where police and public expectations seem to align.

Limitations

While respondents were randomly selected from a large national database to receive the study solicitation, one could argue that this is still a convenience sample. Regardless, we believe that this sample is representative of law enforcement

personnel and agencies across the USA. The survey instrument was also distributed prior to the tragic attack at Robb Elementary School in Uvalde, TX. It is possible that officer perceptions have shifted since this attack. However, we believe that they would shift further in the direction that this research already shows. That is, we believe that respondents would feel even stronger that officers should respond without waiting for backup if there are indications of an ongoing driving force such as active gunfire. Lastly, a survey will never be a true substitute for a real-life active shooter event. Even though this vignette design incorporated as many data points as possible derived from the current FBI active shooter data, a real active shooter event may present different factors than what are considered here. Along this same line, respondents provided their belief about how they would respond to an active shooter with an active driving force; however, the vignette presents a hypothetical situation within which respondents were not responding to a real event with actual risks to their life or the community.

Future research

While this manuscript provides additional data regarding law enforcement perceptions of active shooter response protocols, little is known about public perceptions. We are required to estimate the public's perception based on ongoing legal cases as well as media coverage following an active shooter event. For this reason, it is encouraged that this line of research continues to better understand what the public thinks about law enforcement response options during an active shooter event. This nuanced understanding could help shape future active shooter response policies. Additionally, we encourage future research to explore reasons why a present driving force may be resisted by some law enforcement officers. One promising framework to guide this line of inquiry is resilience engineering or resilience training (see Blair & Duron, 2022).

Appendix 1: Vignette including all factors

On a Saturday at 3:00 pm, a police dispatcher broadcasts across the radio that there is a shooting in progress at *a convenience store (max occupancy 20 people)/a grocery store (max occupancy 500 people)/a large mall (max occupancy 5000)*. About 3 min later, *patrol unit armed with a pistol/a patrol unit armed with a pistol and rifle* arrives on scene. As the first unit arrives on scene, radio traffic indicates that additional backup units are *less than 2 min/2 to 5 min/more than 5 min* from arriving on scene. The scene *appears normal with nobody in distress/is somewhat chaotic, with several people running from the main door of the building/is somewhat chaotic, with several wounded and bleeding people running from the main door of the building*. *Continuous, rapid gunfire/no gunfire* is heard coming from the building. The decision is made *to wait for additional officers before entering the building/to establish a perimeter and wait for a SWAT team to enter the building/to immediately enter the building*.

Appendix 2

Table 4 Results table with all models

	Model 1		Model 2		Model 3		Model 4	
	Odds ratio	SE	Odds ratio	SE	Odds ratio	SE	Odds ratio	SE
Department size (small)								
Medium	0.88	0.10	0.89	0.11	0.88	0.10	0.90	0.12
Large	1.18	0.13	1.19	0.15	1.19	0.13	1.22	0.16
Age	1.00	0.00	1.00	0.01	1.00	0.00	1.00	0.01
Supervisor (no)								
Yes	0.83 *	0.08	0.78 *	0.08	0.82 *	0.08	0.78 *	0.08
Active shooter policy (no)								
Unsure	1.05	0.17	1.06	0.21	1.04	0.17	1.04	0.21
Yes	1.01	0.12	1.01	0.14	1.00	0.12	1.00	0.14
Race (white)								
NonWhite	1.12	0.12	1.07	0.14	1.11	0.12	1.07	0.14
Patrol officer (no)								
Yes	1.08	0.10	1.16	0.12	1.08	0.10	1.16	0.12
Attack location (convenience store [< 20 people])								
Grocery store (21–500 people)	0.92	0.07	0.90	0.07	0.91	0.07	0.90	0.07
Mall (501–5000 people)	0.97	0.07	0.96	0.08	0.97	0.07	0.96	0.08
Unit type (pistol)								
Pistol and rifle	0.98	0.06	0.95	0.06	0.97	0.06	0.95	0.06
Time for backup (<2 minutes)								

Table 4 (continued)

	Model 1			Model 2			Model 3			Model 4		
	Odds ratio		SE	Odds ratio		SE	Odds ratio		SE	Odds ratio		SE
2–5 minutes	1.01		0.07	1.01		0.08	1.01		0.07	1.01		0.08
> 5 minutes	1.02		0.07	1.03		0.08	1.01		0.07	1.03		0.08
Scene (calm)												
Chaotic w/ people fleeing	0.80	**	0.06	0.74	***	0.06	0.66	**	0.08	0.63	**	0.09
Chaotic w/ wounded and bleeding fleeing	0.76	***	0.05	0.71	***	0.06	0.64	**	0.08	0.59	***	0.08
Gunfire (no gunfire)												
Rapid gunfire	0.43	***	0.03	0.13	***	0.02	0.42	***	0.03	0.12	***	0.02
Officer decision (set perimeter)												
Wait for backup	2.29	***	0.16	3.24	***	0.32	2.62	***	0.31	4.13	***	0.63
Immediately enter	13.91	***	1.09	2.72	***	0.26	8.25	***	1.03	1.49	**	0.22
Decision * gunfire												
Wait for backup * rapid gunfire				0.58	**	0.10				0.56	***	0.09
Immediately enter * rapid gunfire				77.95	***	14.59				80.30	***	15.13
Decision * scene												
Wait for backup * chaotic people fleeing							0.92		0.16	0.81		0.16
Wait for backup * chaotic wounded and bleeding fleeing							0.74		0.13	0.65	*	0.13
Immediately enter * chaotic people fleeing							2.03	***	0.36	2.15	***	0.42
Immediately enter * chaotic wounded and bleeding fleeing							2.52	***	0.46	2.94	***	0.59
AIC	8235.02			7150.15			8188.13			7093.48		
BIC	8373.02			7301.94			8353.73			7272.88		

Reference groups in parentheses

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

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Declarations

Conflict of interest The authors declare no competing interests.

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Endnotes Equation 1 Multilevel logistic regression equation with level 1 explanatory variables.
$Log[p_ij/(1-p_ij)]=\beta_0 j+\beta_1 x_ij$
Equation 2. Multilevel logistic regression equation with level 2 explanatory variables.
$\beta_0 j=\beta_0+u_i j$
Equation 3. Combined multilevel logistic regression equation with level 1 and 2 explanatory variables.
$Log[p_ij/(1-p_ij)]=\beta_0+\beta_1 x_ij+u_i j$

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M. Hunter Martaindale is the director of research at the ALERRT Center at Texas State University and a research associate professor at within the School of Criminal Justice and Criminology. His research interests include multiple aspects of law enforcement performance such as innovative interventions to improve decision-making as well as the impacts of acute stress on performance. Additionally, he studies active shooters/attack events.

William L. Sandel is an Assistant Professor of Criminology and Criminal Justice at Missouri State University. His research interests include police and citizen perceptions of use-of-force, police tactics, active shooter events, and hostage negotiations. He also conducts research in the area of conservation criminology where he uses his background in Marine Biology to examine crimes against wildlife.

J. Pete Blair is the Executive Director of the Advanced Law Enforcement Rapid Response Training (ALERRT) Center at Texas State University. His research has focused on active-shooter events, police tactics, and deception detection. His research has resulted in journal publications and books. He has been invited to speak on active shooter events and police tactics by groups across the USA and internationally.