Police Practice and Research
An International Journal

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/gppr20

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To cite this article: William L. Sandel , M. Hunter Martaindale & J. Pete Blair (2020): A scientific examination of the 21-foot rule, Police Practice and Research, DOI: 10.1080/15614263.2020.1772785

To link to this article: https://doi.org/10.1080/15614263.2020.1772785

Published online: 31 May 2020.

POLICE PRACTICE AND RESEARCH
https://doi.org/10.1080/15614263.2020.1772785

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A scientific examination of the 21-foot rule

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ABSTRACT

The purpose of this study was to scientifically assess the long-standing 21-foot rule. There are several anecdotal publications looking at the 21-foot rule as a standard in policing. This study uses experimental design to examine whether this standard should continue in modern-day policing. The 21-foot rule was tested in three independent experimental design studies. The first study measured the average speed at which a person could run 21 feet. The second and third studies tested the speed at which an officer could draw and fire their weapon with no stress and under stress respectively. The final study examined methods for increasing survivability for the officer (movement). The findings show the 21-foot rule to be an inadequate standard for officers to safely draw and fire their weapons when being charged by a suspect who's intent it to cause harm. Additionally, different strategies of moving can increase the officer's ability to survive.

ARTICLE HISTORY

Received 13 February 2020
Accepted 4 May 2020

KEYWORDS

21-foot rule; safe distance; 21 feet; Tueller drill; police training

Introduction

Officer involved shootings have been an issue of great concern to the public. We have seen riots and protests (such as those in Ferguson, Missouri; Sacramento, California; Chicago, Illinois) in response to shootings that the public (or at least some segments of the public) thought were unjustified (Shin, 2017; Simon et al., 2018; Sobol et al., 2018). This is not only a problem in the United States. Officers from around the world also experience use of force encounters involving a suspect with an edged weapon (Associated Press, 2008). Pundits often take to the 24-hour news channels to pronounce whether or not a particular shooting was justified, often before the facts are known, and sometimes seemingly with a desire to do nothing but incite the community. Other media outlets publish story after story with their take on whether or not the officer(s) involved should have fired. High profile shootings have also led at least one state, California, to enact legislation that would increase the legal threshold necessary for officers to use deadly force (CA AB-392, 2019).

At the same time, police officers are also greatly concerned about deadly force encounters. Police departments place a high priority on protecting their community. They want deadly force to be used as infrequently as possible and only when necessary to protect lives. Not only can the use of deadly force negatively impact public perceptions of the police, but many officers also experience significant mental trauma and leave policing after they are involved in shootings (Follette et al., 1994).

Police departments also place a premium on the safety of their officers. Policing is a dangerous profession where suspects have been known to assault police officers and sometimes these assaults are potentially deadly to officers. Departments seek to provide their officers with the equipment, training, and skills to successfully avoid using deadly force where possible, but also to effectively use

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deadly force when it is necessary to protect themselves or others. The following story demonstrates such an encounter.

On 17 December 2018 a man armed with a knife and screwdriver began chasing people at a gas station in Oklahoma City, Oklahoma. Upon arriving at the scene, officers commanded the suspect to drop the weapons. The suspect then charged the officers and the officers used a taser and beanbag gun in an attempt to stop the suspect's assault. The less-lethal force had no effect on the suspect, who continued to move aggressively toward the officers. The officers then used their handguns, which resulted in the death of the suspect (KOKO, 2018). Was this reasonable?

While there has been substantial research into police use of force in general, and shootings in particular, there has been relatively little research into the human performance factors involved in police shootings. Little is known about how quickly and effectively an officer can respond to different types of threats; yet, this is exactly the type of research that should inform public, court, and police perceptions of use of force events. Better understanding of these factors can help protect the police by helping them to understand and avoid dangerous situations. The public is also protected when police have a clear understanding of the dynamics of these situations and their actual response capabilities, resulting in better decisions about when force should be utilized and when it should not.

This paper seeks to fill some of this knowledge gap by examining the '21-foot rule' that is taught across the country to police officers as either a) the minimum distance that a suspect can cross and attack an officer with a knife before an officer can draw and fire his or her weapon, or b) a safe distance to deal with potentially dangerous suspects armed with knives. We report on three studies that explore how fast a person can cross a 21-foot distance, how quickly and accurately officers can draw and fire their weapons, and some defensive tactics that officers can use to further protect themselves in potentially deadly situations. We turn now to our literature review. We begin with an overview of use of force by and against police, then turn to reasonableness, followed by research on the 21-foot rule, and finally end with a discussion of reaction time.

Literature review

Use of force

By officers

It has been well established that officers rarely use force in their daily job duties. A report by the U.S. Department of Justice stated that of an estimated 40 million instances of police/citizen contact, only around 1.4% involved use of force (Eith & Durose, 2011). It is difficult to say what percent of those encounters involve the use of a firearm by the officer, but federal records show a total of 435 justifiable homicides by law enforcement officers in 2016 (Federal Bureau of Investigation, 2017). While police shootings are rare, as we discussed above, they can have a substantial impact on the suspect, community, and the officers. It is, therefore, critical that police training for these situations be validated in as thorough a manner as possible.

Against officers

According to the National Law Enforcement Officers Memorial Fund (2017, 2018)), there were 33 officers killed in the line of duty between 2007 and 2017 as a result of close-quarters physical encounters. Of these 33 officers, 13 were stabbed, 16 were beaten, and four were strangled. Though this may seem like a relatively low number of deaths, violent close encounters occur much more frequently. The Law Enforcement Officers Killed and Assaulted (LEOKA) data from 2007–2016 provided by the Federal Bureau of Investigation (FBI) reports the number of officers assaulted while on duty. It was found that 9,586 officers were assaulted with an edged weapon (Law Enforcement Officers Killed and Assaulted (2018). Of those 9,586 officers, about 1,200 were injured as a result of the encounter. When considering physical assaults with no weapon, 444,741 officers were assaulted and nearly a third were injured (Law Enforcement Officers Killed and Assaulted (2018).

Use of force and reasonableness

An officer's decision to use force, including lethal force, is constrained by the legal standard of objective reasonableness. The Supreme Court of the United States held in Tennessee v. Garner (1985) that a police shooting was considered a seizure under the Fourth Amendment and must be 'reasonable.' The Court later added specificity to the standard of reasonableness in Graham v. Connor (1989). The Court held that any force used by law enforcement must be 'objectively reasonable' based on the totality of the circumstances and the facts known to him or her at the time. Additionally, the Court opined that this standard of objective reasonableness should be judged 'from the perspective of a reasonable officer on the scene, rather than with the 20/20 vision of hindsight,' (Graham v. Connor, 1989, p. 396). There have been several other court decisions that have involved the standard of objective reasonableness (see for example, Johnson v. Glick, 1973; Illinois v. Gates, 1983; Sharrar v. Felsing, 1997), but the underlying logic of *Graham* is the law of the land.

Under *Graham*, and other court rulings, an officer's actions can be deemed reasonable if the actions in the moment, with the same facts available to the officer, would be considered reasonable by another officer. This standard of objective reasonableness is used by law enforcement agencies to establish use of force policy (Terrill, 2009). For example, it is reasonable for an officer to utilize deadly force if the suspect is attempting to kill or seriously injure the officer or another civilian. However, deadly force would not be considered proportional, and therefore would not be reasonable, if the suspect is verbally assaulting the officer.

Some scholarship informs courts about the reasonableness of police shootings. For example, a line of research on perceptual distortions has found that police commonly experience tunnel vision, auditory blunting, and time dilation both immediately before and during shootings (Campbell, 1992; Klinger & Brunson, 2009; Solomon & Horn, 1986). This information can be important both for a court trying to understand an officer's account of a shooting and for officers to better understand what they are likely to experience during a shooting.

When one is attempting to determine objective reasonableness of a use of force incident, it is imperative to take into consideration what the officer was experiencing at the moment of the incident. Klinger and Brunson (2009) established a snowball sample of 80 officers (113 total incidents) that had shot citizens in the line of duty. They found varying levels of auditory blunting in 82% of cases. Fifty-one percent reported tunnel vision, while 56% reported heightened visual acuity. Slow-motion time was experienced by 56% of the officers and fast-motion time occurred in 23% of the cases. Of the officers experiencing some form of perceptual distortion, 87% reported the perceptual distortion before shooting and 92% reported experiencing distortions during the shooting.

These distortions may have a profound impact on how the officer perceives the behaviors of a suspect due to the amount of stress an officer is under when deciding to use force. Keinan (1987) found that people made decisions before considering all available data when a stressor was present during decision-making. Therefore, understanding these distortions is relevant to assessing the objective reasonableness of police shootings. In the next section, we consider the 21-foot rule.

The 21-foot rule

Lieutenant John Tueller laid the framework for the 21-foot rule in the 1980 s when conducting firearms training with the Salt Lake City Police Department. Lieutenant Tueller had one officer play the role of a suspect with an edged weapon while another officer stood about 21 feet away with a holstered training weapon. The 'suspect' was instructed to charge the officer in attack mode to simulate a real-world attack scenario and the officer was instructed to draw and fire before the suspect reached him or her (Martinelli, 2014). This exercise was designed as a reactionary gap drill to teach officers how quickly these encounters unfold. After running this drill for several years, Lt.

Tueller found that the average person could run 21 feet in approximately 1.5 seconds (Tueller, 1983). Additionally, Tueller found officers were able to draw and fire a holstered sidearm in approximately 1.5 seconds (Tueller, 1983). Lieutenant Tueller published these findings in *SWAT Magazine*. He considered 21 feet to be the 'danger zone' for a police officer (i.e., an officer will be unable to defend him/herself if a suspect charges from 21 feet or closer).

However, the information in this article was interpreted by some agencies as 21 feet being a 'safe distance' for police encounters involving a charging assailant (i.e., the officer will be able to defend him or herself if a suspect charges from 21 feet). Twenty-one feet as a safe distance became even more prominent with the distribution of a training video called *Surviving Edged Weapons* (Smith, 2018). This training video emphatically stated that 21 feet was far enough for officers to be able to (1) draw their weapon, (2) aim and fire two shots at center mass, and (3) move away from the suspect after firing. Across the country, there are departments that base their training and use of force policies (at least partially) on the 21-foot rule (Police Executive Research Forum, 2015, 2016).

This is despite the fact that peer reviewed research on the 21-foot rule is lacking. Most reported data on the 21-foot rule are published in non-academic, trade-type publications (Adams, McTernan & Remsberg, 2009; Blake, 2016; Force Science Research Center, 2005a, 2005b; Martinelli, 2014, 2015; Smith, 2018; Tueller, 1983). Generally, these inquiries simply rerun the original Tueller drill with imprecise measures of speed (e.g., a smartphone stopwatch). While this does not mean that these data are incorrect, more controlled, peer-reviewed, empirical research is needed to ensure that both police officers and those who will judge the actions of police officers have reliable data. Next, we consider the 21-foot rule as a specific type of reaction time experiment.

Reaction time research

The scenario laid out by the 21-foot rule is essentially a reaction time experiment. At some point during an interaction with a police officer, a suspect decides to charge with a knife. The officer must perceive that the attack is happening and react accordingly. There are three common types of reaction time experiments (Luce, 1986). Simple reaction time experiments feature only one stimulus and one response (e.g., press the button when the light turns on). Selective response studies require the participant to respond to only some types of stimuli and ignore others (e.g., press the button when you see a red light, but not when you see a green light). Participants in this type of study must react to the relevant stimulus and inhibit their response to the irrelevant. Choice reaction time experiments require the participant to give a specific response to a specific stimulus (e.g., press the right button when you see the red light and the left button when you see the green light). The situation of a suspect charging an officer is a choice reaction time problem for the officer. The officer must detect the stimulus (e.g., the suspect charging the officer) and then choose a response (e.g., shoot, move, give commands). Research has shown that reaction time increases as the complexity of the task increases (Brebner & Welford, 1980; Luce, 1986). Reaction times are the fastest in simple reaction time studies and slowest in choice reaction time experiments.

Law enforcement specific reaction time research

Lewinski and Hudson (2003a) found that the average reaction time for police officers to pull the trigger of a gun in response to a light was 0.31 seconds. Three-quarters of that time (0.23 seconds) was taken up with processing and one fourth (0.08 seconds) with the actual physical motion of moving the finger from the resting position and firing. This finding was consistent with non-law enforcement reaction time research, which found that reaction times to simple visual tasks were around 0.20 to 0.30 seconds (Eckner et al., 2010; Welchman et al., 2010). In a more complex scenario where officers had to process information from a number of lights in different rows when making the decision to shoot, the reaction time almost doubled to 0.56 seconds (Lewinski & Hudson, 2003b). Again, this was also consistent with general reaction time research which indicates that complexity slows reaction time (Brebner & Welford, 1980; Luce, 1986).

In a more recent study, Blair et al. (2011) studied reaction times of officers when forced to make a deadly force decision in a dynamic scenario rather than a laboratory setting. The suspects in the study were armed with a pistol either pointed to the ground or to their own heads. The officer would turn and face the suspect with his or her gun drawn and issue compliance commands. The suspect either complied or attempted to shoot the officer. The officer would attempt to fire on the suspect once he or she recognized the suspect's intent to fire at the officer. Suspects fired in 0.38 seconds on average while officers fired in 0.39 seconds on average. Thus, the process of observing a suspect's hostile movement, interpreting the movement, deciding to take lethal action, and acting on the decision resulted in the officer firing after the suspect even though the officer already had his or her gun aimed at the suspect before the hostile movement (Blair et al., 2011).

Blair and Martaindale (2014) studied law enforcement officers' ability to shoot before suspects while performing room entries where a student volunteer was waiting to ambush the officer. Blair and Martaindale (2014) found that the officers fired first in only 43% of the runs. In a series of follow-up studies, Blair and Martaindale (2017) found that deploying a simple distraction device (e.g., tossing a chair in the room) slowed suspect reaction times while officers performed room entries. In this experiment, officers utilizing a simple distraction device had a slight reaction time advantage. As a whole, it appears that in at least some common law enforcement situations, police officers are at a reaction time disadvantage to suspects, but there are techniques to alleviate this disadvantage.

The current manuscript will assess the issues of reaction time by breaking down the 21 foot rule into manageable research questions.

Research questions

The literature shows that law enforcement officers rarely have to use force. However, they are constitutionally required to make objectively reasonable force decisions when force is necessary. Some previous research shows that an officer is at a time disadvantage when reacting to the action of a hostile suspect. However, it appears that strategies can be used to give the officer an advantage (e.g., utilizing distraction techniques) and hopefully keep the officer safe.

The current paper seeks to evaluate the 21-foot rule by addressing four questions:

(1) How fast can a suspect run 21 feet?
(2) Is the officer able to draw and fire before the suspect can move 21 feet?
(3) How fast can an officer draw and fire his or her weapon at a charging suspect?
(4) Is there anything that an officer can do to provide more reaction time?

Methods

Study 1

Study 1 was designed to examine how quickly a suspect could cross 21 feet.

Design

Study 1 gathered baseline data to determine how fast individual participants ran 21 feet.

Sample

Study 1 consisted of students recruited from criminal justice classes at a large southwestern state university as part of course credit. A total of 76 students participated in study 1. The mean age was 20.79 (SD = 2.8) years. Of the 76 participants, 50% were Hispanic, 34.2% were Caucasian, 13.2% were African American, and 2.6% were Asian or other. Most of the participants were female (54%).

Four students had only prior military experience and one participant had prior law enforcement experience and military experience.

Method

To measure how much time is required to run 21 feet, we used purpose built laser timing gates. Participants ran individually and were instructed to run as fast as they could down a hallway as if they were charging a police officer with the intention of harming him or her. Simply put, the participant would line up on the starting line. The first laser was placed at the starting line so the initial forward movement would start an electronic timer. As the participants hit the 21-foot mark at the end of the hallway, they would cross the second laser, which would stop the timer. This gave us an assessment of how quickly the participants could run 21 feet.

Results

Participants ran 21 feet in an average of 1.5 seconds (SD = 0.14). The run times ranged from 1.24 seconds to 1.83 seconds.

Discussion

The results for Study 1 were similar to other studies that examined the run speed over 21 feet (Force Science Research Center, 2005a, 2005b; Martinelli, 2014, 2015; Tueller, 1983). Individuals charging an officer can cover a distance of 21 feet in 1.5 seconds on average. The next step was to test the average draw speeds of the officers.

Study 2

Study 2 was designed to address part of research question 2: How quickly can an officer draw and fire his or her weapon?

Design

Study 2 gathered baseline response data where each participant drew and fired their weapon at a silhouette when a light was turned on.

Sample

Study two consisted of police officers who were attending classes at a law enforcement training center and officers from a municipal police department located in a mid-sized central Texas town. The sample included local, state, and federal officers from a number of jurisdictions throughout the U.S. A total of 152 officers participated in study 2. The mean age was 39.02 (SD = 9.31). Most of the officers were Caucasian (75%) and a vast majority were male (92.2%). The demographics of this sample closely match the demographic breakdown of law enforcement in the US where 88% of officers are male and 72% are Caucasian (Haley & Davis, 2019). The mean number of years of experience was 13.21 (SD = 9.33) and ranged from ½ year to 40 years. Most of the sample were patrol officers (55.9%). Only nine of the 152 police officers were on a Special Weapons and Tactics (SWAT) team. They had a mean of 17.67 (SD = 7.89) years of experience. Additionally, the retention level of the individual officer's holster was reported. As this study involved the officer drawing their weapon, the retention level of each officer's holster was recorded. There are three levels of retention with level one being the easiest to remove a weapon from and a level three being the most difficult. Officers used a level two holster in study two 56.6% of the time.

Methods

This study was designed to test the draw speed and accuracy of officers in a sterile environment. Simply, the officers were told to draw and fire a pistol in response to a simple stimulus. This stimulus for this study was a lightbulb turning on. Before the start of the study, all officers removed live weapons and were patted down for safety by the researchers. The officers were told that their draw speed and accuracy were being researched as part of an examination of the 21-foot rule. Officers were tested one at a time during this study. The participating officer was given a Glock 17 T training pistol, which fires Simunition marking rounds that are filled with a mixture of paint and detergent (Blair et al., 2011). These rounds are propelled by gun powder and break when the plastic shell hits a hard surface. Officers were provided with a single Simunition round and told to holster the training pistol in their actual duty holster. The retention level for each individual holster was recorded prior to the study. Across from the officer was a silhouette target pinned to a whiteboard. The silhouette was black to ensure the white paint rounds would be visible when the target was hit. The officer was instructed to stand at an interview stance, which means that their hands could not be resting on their weapon in anticipation of drawing. This was done in order to get accurate draw speeds. The light was on a pillar down range and was connected to a switch held by the researcher behind the officer. Once the light turned on, the officer would draw and fire the training pistol as quickly and accurately as possible at the silhouette.

Each officer was recorded using a 30 frame per second (fps) handheld camera mounted to a tripod. The camera was in position to capture the training pistol being drawn and pushed out towards the target. As the silhouette was down range, the camera was also able to capture the entire target. Hits on the target were able to be recorded during the study and the camera footage was analyzed later to get speed data. Using video editing software allowed the researchers to move through the videos frame by frame (30 fps) to get accurate timing from when the light turned on to when the officer fired their one and only round. These times were calculated by individually coding the frame in which the light turned on, the officer first touched their weapon or holster, when the weapon cleared the holster, and when the shot was fired. Knowing that the camera was recording at 30 fps it was a matter of simple math to get the corresponding amounts of time for each event. Twenty percent of the cases were coded by another researcher for reliability with a reliability of 100% (Intraclass Correlation Coefficient (ICC) = 1).

Results

Study two was designed to test the speed at which an officer can draw and fire their weapon under sterile conditions. It took the officers an average of 1.80 seconds to draw and fire a single shot at a silhouette (SD = 0.46, 95% CI = [1.73, 1.87]). During study two several officers had trouble getting their weapons drawn causing several outliers. The median for the study two sample was 1.73 seconds. The speeds ranged from 1.03 seconds to 3.4 seconds. During study two the hit percentage of the officers was also captured. Of the 152 officers, 14% missed the silhouette altogether.

Discussion

Recall that it took an average of 1.5 seconds for someone to run 21 feet while it took 1.8 seconds for an officer to draw and fire his or her weapon. There was a significant difference between the run speeds and the time it takes to draw and fire a weapon ($t = -5.53$, $p < 0.001$, Cohen's $d = 0.88$). Meaning, participants were covering the distance significantly faster than officers were able to draw and fire their weapon in Study 2. Being that these types of encounters are stressful, study three was designed to include stress as a factor for officer draw speeds.

Study 3

Study 3 was designed to address research question 3 fully: How quickly can an officer draw and fire his or her weapon at a charging suspect?

Design

Study 3 gathered baseline data regarding how fast each participant drew and fired his or her weapon in response to a suspect (actor) charging them.

Sample

The sample consisted of police officers who were attending classes at a training center and officers from a municipal police department located in a mid-sized central Texas town. A total of 57 police officers participated. The sample included federal, state, and local law enforcement from around the US. The mean age was 37.95 (SD = 8.67). Most officers were Caucasian (77.2%) and male (86%). Once again, these demographics are fairly close to national breakdown regarding gender and race. The mean number of years of experience was 11.98 (SD = 9.26) and ranged from ½ year to 31 years. The primary job duty for 42 of the 57 officers was patrol. This sample was smaller than the officer sample from study 2 because there were less training classes taking place during study 3 data collection. Study 2 data collection occurred during the peak training season for the law enforcement training center.

Method

This study was designed to capture an officer's draw speed and accuracy when the officer was exposed to a stressor. Stress can alter a person's fine motor skills, which can greatly affect his or her ability to perform normal tasks (Grossman & Christensen, 2007; Martaindale et al., 2017). The stressor in this study was a suspect armed with a shock knife standing 21 feet away. A shock knife is a training tool designed to look like a knife. Instead of having a sharp edge, electricity arcs around the edge of the knife where the blade would be. The knife makes popping noises like a Taser when activated and delivers an uncomfortable shock if touched.

The participant officers were given a training pistol that fired force-on-force training rounds. The training pistol was loaded with one training round. All officers placed the training pistol in their duty holsters. The officers were told that their draw speed and accuracy were being researched as part of an examination of the 21-foot rule. Additionally, the officers were told that they would be going through a series of scenarios that may or may not involve the use of the training weapon. This was done so that officers would not be primed to always draw and fire. In reality, each officer completed only one scenario, and in this scenario, the attacker wielding the shock knife always charged the officer.

At the start of the scenario, the officer was told that he or she was responding to a disturbance outside of a bar and that the suspect needed to be interviewed. The officer was placed inside of a square marked with tape on the floor and instructed to stay inside of this box. The suspect was played by an assistant wearing a force-on-force protective mask, a baggy jacket, and protective gloves. The shock knife was concealed in one of the jacket pockets. We discovered during pilot testing that officers would often try to game the system by keeping their hands near their holsters and their body tensed to react. To counter this, the suspect would engage in a few minutes of conversation with the officer to allow the officer to acclimate to the scenario and behave more normally. At some point during the interview, the suspect would charge the officer while pulling the shock knife out of his pocket. It was not the goal of the assistant to reach the officer and make contact with the shock knife. The suspect would charge the officer straight on until the last second when he would veer off to one side of the officer. The initial movement of the suspect was the stimulus for the officer to draw and fire his or her weapon, and the use of the shock knife was designed to provide some stress to the officer.

A GoPro camera running at 30 frames per second was used to record each exchange. The camera was set at hip level next to the officer's holster to capture the entire scenario. Hits and misses were recorded during the individual runs of the scenario. The suspect's initial movement, the point at which the officer touched his or her weapon or holster, and the frame where the officer fired the weapon were coded using Adobe Premiere video editing software. Using these frame counts, the time for each action was calculated. Twenty percent of the cases were coded by another researcher for reliability with a reliability of 100% (ICC = 1).

Results

Study 3 was designed to test officer draw speed and accuracy under stressful conditions. Of the 57 officers participating, seven did not draw their weapon successfully and, therefore, did not shoot.

These officers had difficulty clearing the retention systems on their holsters. The average time it took an officer to touch their weapon/holster once the suspect began to move was 0.32 seconds (SD = 0.09, Range = 0.1–0.63 seconds). It took the officers an average of 0.68 seconds (SD = 0.24, Range = 0.3–1.27 seconds) after that to draw their weapon. Once their weapon cleared the holster it took an average of 0.43 (SD = 0.10, Range = 0.17–0.78 seconds) seconds to raise and fire their weapon. Of the 50 officers who drew their weapons, the average reaction time to draw and fire was 1.43 seconds (SD = 0.26, Range = 0.93–2.4 seconds). Of the 50 officers who fired, 38 (76%) struck the charging suspect.

Discussion

Study 3 revealed that the reaction time of police officers was slightly, but significantly, faster than the 1.5 seconds that it took suspects to run the same distance in Study 1 (t = 2.27, $p < 0.05$, Cohen's d = 0.38). Figure 1 presents the distributions for both the suspect run times and officer draw times. Seventy-eight percent of the distributions from Study 1 and Study 3 overlap, showing that if officers were randomly paired with runners, they would not shoot before the suspects reached them in many encounters. Recall that in 7 (12%) of the runs, the officers failed to draw and fire their weapons. These officers could not be analyzed using time data as they never completed the task. These cases demonstrate the fact that some officers may never successfully draw their weapon resulting in a 'loss' for the officer. This is a whole new topic that could be analyzed and discussed in future research. Additionally, officers hit the charging suspect in only about 3/4 of the runs. Unless these shots hit the suspect in the central nervous system they would likely be ineffective at stopping the suspect from continuing to charge the officer. Also keep in mind that these scenarios were only moderately stressful. Real life and death encounters would be substantially more stressful and would likely result in higher failure to fire and miss rates. Taken together, these results clearly show that 21 feet is not a safe distance. Our results suggest that the answer to research question 3 (Can officers draw and fire before a suspect moves 21 feet?) is no.

Our calculations suggest that in order for 95% of the officers who successfully drew and fired their weapons to fire before the suspect reached them would require the officer and suspect to be about 32 feet apart. Clearly many police contacts must occur at distances that are closer than 32 feet. This suggests that the police should utilize tactics to mitigate this potential threat. Many tactics are

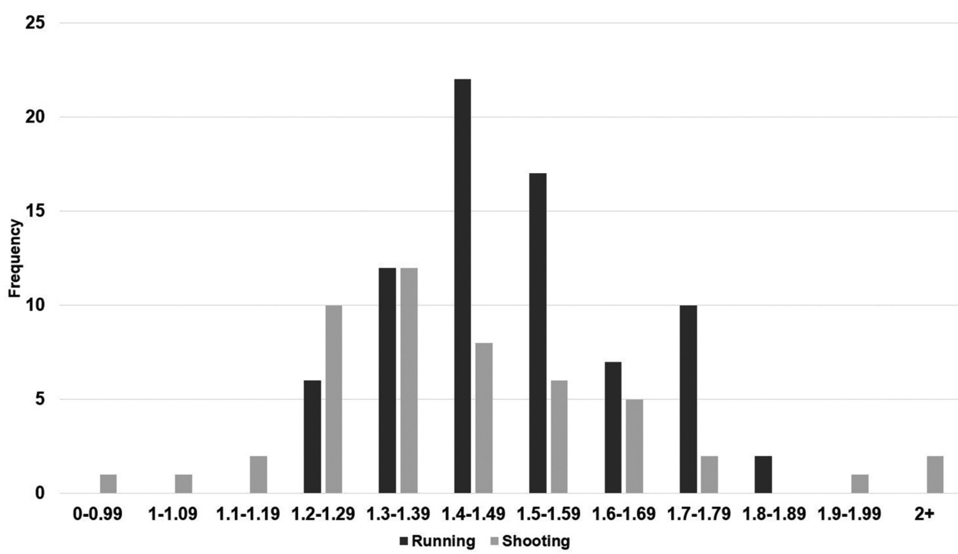

Figure 1. 21 foot run times v. shooting under stress.

currently used. For example, having suspects face away from officers and put their hands on their heads would provide officers with more reaction time. Approaching a suspect so that there are obstacles between the suspect and the officer is another tactic. We wanted to address a different suggestion that seems to be popular in training circles. The tactic involves the officer moving from the location where he or she was standing when that attack began.

Study 4

Study 4 assessed what impact officer movements had on suspects' ability to charge and touch an officer with a marking knife.

Design

Study 4 was a 1 × 4 independent groups design with random assignment to test conditions. The test conditions were no movement, a 45-degree angle towards the suspect, sidestepping, and backstepping.

Sample

Participants were recruited from criminal justice classes at a large southwestern university as part of course credit. A total of 137 students participated in study four. The mean age was 21.56 (SD = 3.73) years. Of the 137 participants, 40.9% were Caucasian, 39.4% were Hispanic, 15.3% were African American, and 4.4% were Asian or other. Most of the participants were male (55.5%). Three participants had prior law enforcement experience, one of whom also had prior military experience. Seven other individuals had only prior military experience.

Method

Participants played the role of suspects who were being questioned by a police officer. They were told that, as the officer questioned them, they should charge the officer and try to 'cut' him with a chalk knife whenever they felt ready. The chalk knife is a plastic knife-shaped training tool that has felt around the edges. This felt holds chalk and leaves a mark when it touches something. Participants were also told to get to the officer as quickly as they could from 21 feet away. The same highly experienced officer completed all runs of the study. Based on a fixed condition rotation schedule, the officer either did not move at all, sidestepped, moved at a 45-degree angle towards the suspect, or backpedaled away from the suspect while attempting to draw and fire his pistol. The pistol fired security blanks and was used simply as a stimulus. Participants were randomly assigned to these movement conditions and were blind to what actions the officer would take. The participant playing the suspect was instructed to stop the charge if the officer was able to draw and fire his or her weapon before the participant touched the officer with the chalk knife. The officer reported if he was touched with the knife and was inspected for marks after the run was over. The exchanges were captured by GoPro cameras recording at 60 frames per second and examined by using Adobe Premiere video editing software. Twenty percent of the cases were coded by another researcher for reliability with a reliability of 100% (ICC = 1).

Results

The suspect was able to reach the officer and make contact with the chalk knife 33% of the time when the officer did not move. The officer was touched with the knife 25.6% of the time when he moved in a 45-degree angle toward the suspect. When the officer backpedaled away from the suspect, he was touched 7.7% of the time. The officer was only touched 5.3% of the time when he sidestepped. Using Fisher's Exact test there was a significant difference reflective of a moderate effect size (p = 0.021, Cohen's d = 0.66) when comparing how many times the participants made contact with the knife in the different conditions. When the officer did not move, he was touched 33% of the time. The three types of movement can be aggregated into one large movement group.

For movement overall, the officer was touched 12.9% of the time. There was a significant difference reflective of a moderate effect size (Fisher's Exact p = 0.046, Cohen's d = 0.56, OR = 0.30) between the movement and non-movement group regarding the officer being stabbed.

Discussion

Simple movement techniques allowed the officer to avoid being touched by the knife more than simply standing still and drawing. Moving sideways and backwards in particular were effective. It should be noted, however, that moving backwards is often tactically frowned upon because the officer cannot see what is behind him or her and is at an increased risk of falling. Additionally, this was only an initial look into how movement affected the safety of an officer being charged by a knife wielding suspect.

General discussion

Recall that the average run speed was 1.5 seconds (Study 1), the average draw and fire speed was 1.80 seconds (Study 2), and the draw and fire speed under stress was 1.42 seconds (Study 3; see Figure 2 for a comparison of these three studies). As previously stated, the difference between run speeds and an officer's ability to draw and fire their weapon under stress was significant. However, this is a case of statistical significance not being of practical significance. Practically speaking, the difference of 0.08 seconds translates to 13.4 inches from the chest of the officer to the chest of the suspect. When considering the median run speed of 1.48 seconds this distance drops to just 10 inches. This does not consider if the suspect has an outstretched weapon or if the officer's weapon is fully extended. Once this is considered, the distance between the officer and suspect disappears. The distributions of the officer draw speeds and suspect run times have significant overlap (see Figure 2). This overlap shows that 21 feet should not be considered a safe distance.

The current studies eliminate some of the decision-making process for the officers. Their movements and options were constrained, so there were fewer options to consider. The decision to shoot was devoid of many of the consequences that would accompany an actual shooting. No one

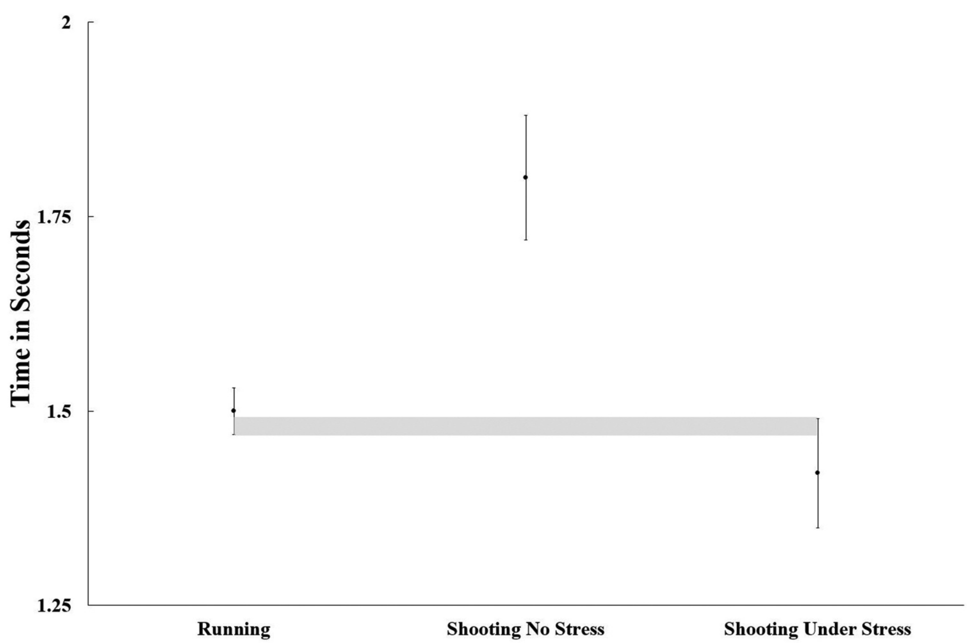

Figure 2. 21 foot run v. shooting with no stress v. shooting under stress confidence intervals.

would be injured; the officers' actions would not be reviewed potentially resulting in disciplinary or criminal sanctions. Some research has suggested that 75% of the time it takes an officer to fire an already drawn weapon in response to a simple stimulus is the decision process; and the remaining 25% is the physical action of pulling the trigger (Lewinski & Hudson, 2003a). Taken together, we believe that the laboratory conditions in these studies present an optimistic picture of officers' ability to respond in real-life, high stress situations. We expect that officers in real shooting situations would perform more poorly than they did here. For example, the accuracy that we observed for officers in Study 3 was 75%. Research into the accuracy of police officers during actual shootings shows that their accuracy is often substantially below 50% (Copay & Charles, 2001; Geller & Scott, 1992; Matulia, 1985; White, 2006). In an evaluation of the New York City Police Department, Rostker et al. (2008) found an average of only 18% of officer shots hit their target.

Additionally, it should be noted that one round may not instantly stop an attacker. There are numerous examples of officers hitting a suspect several times and still not stopping the suspect's movement. This suggests that officers may often need to hit assailants with multiple shots to stop an attack. These additional shots would take more time, suggesting that officers would be at even more of a disadvantage. It should also be noted that the samples used in this study were convenience samples. That being said, the police samples were closely in line with the national demographic breakdown of law enforcement in the US.

Given that officers can be at a reaction time disadvantage when making contact with suspects, it is important to develop officer safety techniques that can mitigate this disadvantage. Study 4 is an initial look into simple movement techniques that can help mitigate the risk to officers. Other techniques (such as shooting from the hip instead of a full 'pushed out' shooting position, falling to your back, or rolling at a 45-degree angle past the suspect) might also mitigate risk. That being said, more training would need to be conducted for officers to become comfortable with multiple response tactics.

Training on different starting positions could also be useful as each use of force encounter is unique. Dysterheft et al. (2013) discuss how different starting positions and target focusing can significantly change a person's sprint velocity over short distances. Lewinski, Dysterheft, et al. (2015) go further by examining the effect of an officer's equipment on movement and discovered that the weight of a duty belt significantly reduced velocity. These studies indicate a number of factors that could reduce an officer's reaction time in a use of force situation. Nieuwenhuys et al. (2017) found increased levels of anxiety among police officers when they had to fire their weapon before moving compared to firing their weapon after moving away from the suspect. Training that covers both tactics might reduce this anxiety and better prepare the officer for instances where one method might be superior to the other given situational factors. Additional research is needed to assess these alternative strategies for all aspects of an officer's reaction time in a use of force encounter.

Policy implications

There are two major implications based on the findings of this research. First, the idea that 21 feet is a safe distance for an officer to stop a charging suspect does not appear to be supported. This is especially true when considering that officers tend to have a high rate of missing the target and that one shot rarely stops a suspect's forward movement. It is also important to remember that this study took place in a laboratory setting, which gave the officers a best-case scenario and the greatest chance of success. No matter its statistical significance, a distance of about one foot on average between the officer and suspect is not a practical distance when considering officer safety. The term 'safe distance' has allowed the 21-foot rule to become a standard in the field, but it places officers in danger.

The second implication comes from the final study. Officers are frequently trained to use their firearms in a very sterile environment when compared to the environment of actual shootings.

Officers generally practice shooting from a static position on the firing line and shoot a known course of fire at a stationary target (e.g., shoot three rounds at center mass; Adams et al., 2009; Aveni, 2003; Lewinski, Avery, et al., 2015). Study 4 found that not moving resulted in a higher percentage of the attackers hitting the officer with the chalk knife. While this is only an initial look into the effect of movement on officer safety, it implies that having officers move while drawing and firing their weapon might be a better method of training. Officers are likely to revert to whatever training they have had when a sudden, stressful situation arises. Having officers only train in a stationary position means they are more likely to remain stationary when being charged by a suspect.

This is often referred to as a 'training scar' in police training circles. A training scar occurs when something done in the training environment (usually for the purpose of expediency) causes the trainee to perform poorly in real-life situations. Most live firearms training is done on a flat range at known distances with fixed courses of fire because this type of training can be done safely with many participants on the training line at the same time (i.e., it is expedient). Having officers move and fire variable numbers of rounds means that far fewer officers can be safely trained in the same area at the same time. Even though trainers know that the training environment does not match the actual shooting environment, they persist in the mismatched training because they can more efficiently move students through the training. This is also one explanation for the low accuracy of police officers in actual shootings. While the officers might have extensive training, the training does not match the real-world shooting task that the officers face. Extensive research in the area of sports training finds that matching training to the specific task produces much better results in actual competitive situations than mismatched training (see, for example, Burroughs, 1984; Christina et al., 1990; Singer et al., 1994; Williams & Burwitz, 1993).

Conclusion

The 21-foot rule seems to have been set as a standard in law enforcement, both socially and legally, with very little evidence or understanding of its consequences. The results from this study show 21-feet to be an ineffective distance for officers to draw and fire their weapon at a charging assailant. Policing involves highly fluid encounters that can change in fractions of seconds. By assigning a specific distance to when it is safe to use a firearm, police officers are limited in their ability to act when necessary. This study points to the potential for removing such anecdotal standards and moving towards effective training for officers who encounter such situations. Recall that for 95% of officers to be able to draw and fire their weapons at a charging suspect successfully, they would need to be 32 feet apart. It is not practical for officers to maintain a distance of 32 during all encounters. However, effective movement techniques could mitigate this distance. The importance of training to improve muscle memory could be highly effective compared to the traditional static shooting positions officers are typically trained in.

Future research into this topic could focus on the ability of officers to move in a variety of environments. As stated earlier, the environment can dictate an officer's ability to move in regards to the suspect. For this reason, different movement strategies in different spaces, apart from those examined in this study, could be researched. This study limited the space used to a flat open area with assigned movements. Future research could set up different environments for officers to train around so that the efficacy of movement training in general could be assessed rather than specific movement methods.

As a final note of caution, we do not intend for this work to be utilized to justify decisions based on 'he was within 21 feet, so I shot him,' thinking. While the distance between a police officer and a suspect is an important consideration in use of force situations, it is only one factor. Police use of force thinking is often much more nuanced than this. Use of force encounters are dynamic and each one presents different situational factors that must be considered (e.g., subjects age, capabilities, position, demeanor, etc.).

We hope that our work will dispel the belief that 21 feet is 'safe' and encourage officers to assess situations more accurately. Officers should know that as they close distance with a suspect, they are giving up the reaction time advantage that distance can create. We also hope that this knowledge will help officers and trainers to develop more techniques and tactics that officers can use when near suspects in order to increase both officer and suspect safety.

Disclosure statement

No potential conflict of interest was reported by the authors.

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