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COMMENTARY

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“Stop the Bleed”: A U.S. Military Installation’s Model for Implementation of a Rapid Hemorrhage Control Program

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INTRODUCTION

Damage control resuscitation, advances in transfusion medicine, as well as the importance of tourniquet use demonstrated during Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF) have helped to revolutionize modern trauma care. These lessons have dramatically improved casualty survival rates to the highest in our military’s history, and are now incorporated into civilian trauma centers in the USA and across the world.^{1,2}

The risk of life-threatening hemorrhage from traumatic injury is the leading cause of death of Americans between the ages of 1 and 46, and is one of the most broadly reaching opportunities for military-civilian knowledge transfer. Outside military conflict, severe bleeding accounts for greater than 35% of pre-hospital deaths and nearly 40% of deaths within the first 24 hours of injury.³ Recent intentional attacks (Hartford, Las Vegas, Parkland, and others) have highlighted the threat posed by severe bleeding. Such attacks have occurred in high traffic locations such as schools, theaters, malls, universities, churches, and concert venues. Military bases have suffered these attacks as well, as demonstrated in Table 1, with 35 killed, and 57 wounded since 2000. The importance of early hemorrhage control, along with rapid identification of immediately correctible causes of death, has proven to save lives, and

has evolved into a cornerstone of Tactical Combat Casualty Care (TCCC).⁴ This knowledge has already been adapted by the civilian groups such as the Committee for Tactical Emergency Casualty Care (C-TECC),⁵ and is becoming standard practice for civilian law enforcement, as well as tactical and emergency medical services teams worldwide.⁶

Recent mass casualty events and battlefield experience led to the Hartford Consensus in 2013, which calls for all responders – including bystanders – to have the education and necessary equipment to stop severe bleeding immediately in the field.⁷ This is similar to the widespread dissemination of CPR use and automated external defibrillators (AEDs) training. The Hartford Consensus highlights the vital link in survival provided by those present in the immediate aftermath of an event resulting in traumatic injuries and recognizes the role these bystanders or “immediate responders” serve in an informal surge capacity to complement the efforts of professional rescuers to save lives.⁸

On October 6, 2015, the White House hosted a “Bystander Stop the Bleed Forum” including leaders from government, academia, professional organizations, and industry, and emphasized the need for widespread public access to bleeding control kits. The U.S. Government’s “Stop the Bleed” (STB) initiative was launched, and since then, bleeding control training curricula have been developed and programs placing bleeding control kits have been implemented in various locations including schools, airports, and communities nationwide. Calls to action have also been published in the mainstream medical literature encouraging continued development and broader universal implementation of bleeding control programs.⁹

The idea for military implementation of STB was prompted by a talk by Dr Lenworth Jacobs at Walter Reed National Military Medical Center (WRNMMC) in August of 2016. Dr Jacobs cited data from OEF/OIF demonstrating our ability for rapid hemorrhage control downrange, but limited capacity for bleeding control at home installations. Shortly thereafter, Joint Base Andrews (JBA) leadership conducted a seminar with trauma experts involving the Army, Navy, Air Force, and civilian surgeons from Johns Hopkins University and

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TABLE I. Casualties of Active Shooters at Military Installations from 2000–2016

Location (Year)	Killed	Wounded
U.S. Army Recruiting Center (2009)	1	1
Fort Hood Soldier Readiness Processing Center (2009)	13	32
The Pentagon (2010)	0	2
Fort Bliss Convenience Store (2010)	1	1
Washington Navy Yard Building 197 (2013)	12	7
Fort Hood Army Base (2014)	3	12
Armed Forces Career Center and Navy and Marine Reserve Center, Chattanooga, TN (2015)	5	2
	35	57

<https://www.fbi.gov>

Harvard University to discuss the most appropriate way to implement a coordinated response to a mass casualty event which included consideration of training multiple tiers of individuals (i.e., active duty, civilians, and other members of the community) and appropriate bleeding control kits and kit locations across the base. This plan was implemented in early 2018 at JBA, and this paper describes the materials and training necessary for a STB program, as well as details of our STB program. It is our hope that JBA's STB program serves as a template for other military or civilian installation's in-garrison hemorrhage control preparedness in the event of a mass casualty situation.

MATERIALS

Widespread use of AEDs has saved lives and has demonstrated effective use by the layperson. A simple and inexpensive hemorrhage control kit such as Bleeding Control basic (B-con) kits offer similar advantages to AEDs from an ease of use standpoint, and may even prove easier to use given the simplicity of tourniquet application. Additionally, the lives saved from traumatic hemorrhage, in general, are young, healthy individuals with many years to live compared with the typical patient requiring AED use. Multiple vendors supply bleeding control kits and offer their own training, but prices vary widely and should be tailored to the institutional needs.

Determining the location of such kits will also be installation dependent. This could vary from co-locating kits with all AEDs and requesting all security forces (SF) and first responders to carry kits, to limiting their placement in high-throughput areas (e.g., hospitals, commissaries/BX, flight line). Additionally, many SF and first responders have first aid kits that are in current use can be adapted with the simple addition of approved tourniquets to become effective bleeding control kits.

Determining the responsible party for maintenance of kits will similarly be installation dependent and kit dependent. STB kits require regular material inspection and updating/replacement of expired equipment (e.g., hemostatic gauze) depending on the contents of the bleeding control kits, as well as

evaluation for maintenance of training certification depending on the training given (TCCC, B-con, or Self-Aid Buddy Care (SABC)).

TRAINING CONSIDERATIONS

Required training can be obtained from multiple sources, one of which is TCCC. TCCC has already proven itself by the most important of metrics: its implementation has been directly linked to lives saved on the battlefield.¹⁰ Members of multiple sectors, from the White House, Department of Homeland security, and the American College of Surgeons (ACS), have recognized the utility of TCCC and used it as a template for the STB campaign.^{11–13}

The ACS has streamlined TCCC training to focus specifically on hemorrhage control for the STB campaign, creating the Bleeding Control basic (B-Con) course – a combination of lecture and hands-on scenario training.^{11,14,15} The lectures are given by experienced medical practitioners augmented by standardized presentation materials. Compared to TCCC – which stresses airway management, recognition and correction of tension pneumothorax, and hemorrhage control – B-Con training focuses primarily on uncontrolled hemorrhage as the most prevalent cause of preventable death from trauma in the USA.^{16,17} Because uncontrolled hemorrhage is also the primary cause of preventable death in the military setting, widespread B-con training has the potential for highest impact using less resources than the full TCCC course requires.^{18,19}

Several potential barriers to widespread B-Con/abbreviated TCCC training exist. One is the unknown long-term knowledge/skill retention for B-Con training. All educational programs have to address knowledge and skill retention issues.^{20,21} Hemorrhage control training is similar to other first aid training interventions in that there is an unknown gap in time between when the training takes place and when the learner will encounter the scenario in the real world and be called upon to act. Multiple studies of first aid training have shown a decay over time of both knowledge and skills.^{20,22} While promising results have come out of the real-world experience for TCCC, currently, the retention of TCCC and B-Con has not been formally tested on a large-scale basis. Skill decay has been recognized as a potential issue for TCCC reflected by the U.S. Special Operations Command (USSOCOM) TCCC transition initiative purposefully training special operations just prior to deployment.¹⁵ The most common method to address the issue of retention is periodic retraining. Thus, a practical retraining interval should be established and tailored to installation needs and resources.

The goal of ongoing training is to reinforce and improve recall of previously learned knowledge and skills.²³ Potential retraining strategies include repeating the original TCCC course, taking an abbreviated TCCC focusing on hemorrhage control, or utilizing online interactive applications. A promising educational application developed by the Defense Health Agency is "Deployed Medicine."²⁴ This application presents all the core principles of the TCCC course in pocket

guides, short videos, and podcasts and is available online and as a mobile smartphone application. This format permits flexible training intervals and could allow for “just in time” (i.e., prior to deployment) delivery. Studies in resuscitation suggest that this type of learning is not sufficient as the only exposure of the material to the learner.²⁵

Point-of-care instructions have been trialed to accompany bleeding control kits, similar to those found with AEDs.^{26,27} AEDs serve as the model for this concept as they have a high incidence of effective use by laypersons using just the embedded point-of-care prompts.^{28,29} In several studies, point-of-care flashcard prompts increased the proportion of correct tourniquet application by laypersons without prior training from 20 to 44%.^{26,27} It is likely that responders with prior training would have higher correct tourniquet application rates and utilize point-of-care instructions more for recall rather than training.

Other options for point-of-care training exist and have been trialed among different civilian-produced bleeding control kits. For example, some kits combine audio guides with visual cues similar to AEDs, while others are using interactive touch screen technology.³⁰ Bleeding control kits will likely also undergo iterative refinement similar to the evolution of AEDs.³¹ As a method of skill retention and retraining, point-of-care prompts have varying costs depending on the device used and its underlying complexity but, in general, they are more cost-effective than in-person retraining. However, despite the ease of application of tourniquet use compared to AEDs, the Public Access and Tourniquet Training Study (PATTS) randomized controlled trial demonstrated more successful correct combat application tourniquet (CAT) application after in-person training as opposed to point-of-care instructions alone, arguing for the need of training beyond point-of-care prompts, as well as refresher training for skill retention.³²

Another potential barrier to widespread hemorrhage control training and dissemination is the availability of medical personnel to serve as instructors for some programs. Not all courses require medical personnel as instructors; one example is Self-Aid Buddy Care (SABC). The training program is typically delivered prior to deployment, covers hemorrhage control essentials, is offered by the National Association of Emergency Medical Technicians (NAEMT), and does not require instructors to be medical personnel. Therefore, B-con and SABC provide avenues for abbreviated courses allowing for rapid skills acquisition and dissemination across installations, simpler recertification/skills verification, and manpower/training flexibility tailored to the installation’s circumstances and requirements. TCCC has unequivocally proven itself to be effective to decrease preventable deaths from extremity hemorrhage in theater, but understanding the limitations to the current TCCC training and utilizing other courses such as B-con and/or SABC, as well as future opportunities and collaborations is key to obtaining the goal of achieving zero preventable deaths via rapid hemorrhage control.¹⁰

IMPLEMENTATION OF STB AT JBA

To procure the materials for our STB kits, we initially contacted the defense logistics agency to develop a standardized kit across the DoD as all branches acquire kits independently, and it was recommended JBA procure custom kits that have already been developed by private vendors.

Several key departures from standard commercially available products were decided upon for our kits here at JBA. For example, the additional cost and maintenance required for hemostatic gauze that expires persuaded us to create custom streamlined kits focusing mainly on tourniquets and standard gauze. We worked with several vendors, and invited one vendor to a field exercise with SF to tailor our kits to the needs of our first responders most likely to use the kits. Our custom kits include: CAT tourniquet, trauma shears, six-inch trauma dressings, rolled gauze, and nitrile gloves. However, the Committee on TCCC recommendation for hemostatic gauze is acknowledged and should be the default provided funding and resupply resources exist.

Our materials include a total of 29 wall mounted kits across the base, 6 throw kits (which contain eight personal bleeding kits) for the fire department, 2 throw kits for SF, and 1 throw kit for the Air Force Memorial. Additionally, SF patrol kits were augmented with 50 tourniquets and emergency bandages, making them effective bleeding control kits. The total cost of these supplies was \$32,600 from our vendor, and we were able to secure this funding through our wing commander’s discretionary funds. These kits were placed in high-throughput areas throughout the base alongside AEDs (see Fig. 1).

Maintenance of kits is currently delegated to building facilities managers where the kits have been placed, although no maintenance is required outside of kit replacement after a mass casualty event. Currently, training is being overseen by emergency managers. Further “waves” of STB implementation here



FIGURE 1. JBA wall mounted bleeding control kit near AED. One wall mounted bleeding control kit contains eight personal bleeding control kits. JBA: Joint Base Andrews; AED: Automated External Defibrillator

at JBA will include additional kit placements and more training programs targeting civilians not captured with current B-con training (e.g., retirees, schools). The public access defibrillation program is another potential route for maintenance of kits and training, as this program oversees BLS/ACLS/AED and code cart maintenance via site coordinators.

Regarding hemorrhage control training, currently all active duty members at JBA are required to have SABC training. Yearly requirements for active-shooter training will now include B-Con training for all members of JBA (active duty and civilian). To target the rest of the base population (i.e., additional civilians), we plan to hold quarterly/bi-annual B-Con rodeos, consisting of 1–2 hour long lectures with hands on skills training and evaluation. One such rodeo was conducted here at JBA on March 19, 2018 in preparation for National STB Day (31 March) where 30 B-Con instructors trained 119 people during two one and a half hour events. We will also plan to incorporate population-specific training, including retirees at appreciation day events, as well as base schools in subsequent rollout waves.

CONCLUSION

The STB initiative has the opportunity to save lives, not only in the public arena but on military installations worldwide. It is critical we educate, train, and prepare for mass casualty events to save lives in our current environment. We have launched our STB initiative here at JBA and hope our program serves as a potential model for other installations to proceed with developing their own in-garrison hemorrhage control program. Implementation at other military installations will likely require minor modifications given the needs and resources present at each individual facility. While, these needs can easily be met with affordable and customizable hemorrhage control kits requiring little maintenance as in our custom kits, caution should be exercised related to extensive modification of kits. The training is equally versatile, and can be targeted to health care professionals and the layperson at large focusing on hemorrhage control through trainings such as TCCC, B-Con, or SABC. Our goal is for every active duty and civilian member of our base be educated in effective hemorrhage control, with ready access to hemorrhage control kits throughout the base. We believe this should be a DoD-wide initiative, and it merits consideration for dedicated funding to support this public health program at other installations.

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