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# Stop the Bleed Education Consortium: Education program content and delivery recommendations

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Following the 2015 White House launch of the Stop the Bleed (STB) campaign various educational programs have emerged to teach hemorrhage control principles to the public. The STB campaign seeks to translate battlefield medicine successes to the civilian sector by empowering the general public to stop life-threatening bleeding.<sup>1-3</sup> Tourniquet use on the battlefield in Afghanistan and Iraq, often by non-medically trained service members, has saved an estimated 1,000 to 2,000 lives.<sup>4</sup> In response to the horrific Sandy Hook, Connecticut school shootings, the American College of Surgeons convened a group of expert representatives from the trauma community, federal government, and emergency response organizations, among others, to form the Hartford Consensus. This group describes the public as “immediate responders” and key to providing point-of-injury hemorrhage

control.<sup>5,6</sup> The Hartford Consensus’ work led directly to the STB campaign, and these efforts are amplified by a seminal 2016 report by the National Academies of Sciences, Engineering, and Medicine, which seeks to integrate civilian and military trauma systems to eliminate preventable traumatic deaths.<sup>7,8</sup>

One of STB’s five goals is that the general public will know how to stop life-threatening bleeding.<sup>2</sup> Although STB emphasizes the need for layperson training, it does not prescribe details for how this education should be accomplished, or what elements it should contain. Today’s public bleeding control programs vary widely, from extensively detailed in-person courses to series of online slides.<sup>3,9</sup> There is no standardized approach to the content, content-delivery mechanisms, nor assessments of effectiveness among existing courses. Currently, it is not clear what it means to be Stop the Bleed trained.

In 2017, the National Center for Disaster Medicine & Public Health convened the Stop the Bleed Education Consortium (SBEC); an informal group of medical educators, public health professionals, and clinicians with expertise in hemorrhage control to address this problem. The National Center for Disaster Medicine & Public Health, established by a Homeland Security Presidential Directive, is a Federal organization supported by a collaboration of five Federal agencies, and an academic center located within the Uniformed Services University in Bethesda, Maryland. In a series of discussions over several months, the SBEC reviewed existing training programs, considered widely accepted challenges in knowledge retention in other layperson medical training programs, and then made recommendations to optimize STB education.<sup>10-14</sup> The SBEC used the curriculum development approach recommended by Kern et al that includes problem identification, needs assessment, goal/objective creation, and educational method design.<sup>15</sup>

The SBEC’s recommendations are intended to establish a common framework for educators designing curricula. Recommendations include establishing tiered training categories, educational domains, objectives, definitions, content, educational design, and assessment. These recommendations are intended to be minimum suggested elements, and are not intended to preclude educators from including additional content or modalities appropriate to their specific learner populations.

## TIERED TRAINING

A one-size-fits-all approach to training is unlikely to succeed for a heterogeneous training audience. The SBEC identified

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three target groups for training, tiered in order of prior health care experience/knowledge: layperson, trained layperson, and health care professionals (Table 1). These tiers follow a similar approach to that used by the American Red Cross for cardiopulmonary resuscitation training. The SBEC's definitions for each tier are:

The *layperson tier* targets people with no medical knowledge and a lesser likelihood of using the material than other tiers. These are people who may spend a few minutes on a website or mobile application, but are unlikely to enroll in additional training.

The *trained layperson tier* consists of those who have greater motivation or need to learn STB material. An example would be non-medically oriented people with occupations that make them more likely to use these skills, such as law enforcement officers or industrial workers. Many people in this tier are already required to complete first aid training as part of their job duties.

Finally, the *professional tier* describes training for medically oriented personnel, and would be appropriate for a wide variety of health care professionals.

## EDUCATIONAL DOMAINS AND OBJECTIVES

Learning domains can be broadly categorized into three primary areas: cognitive (knowledge), psychomotor (skills), and affective (attitudes).<sup>16</sup> All tiers of STB training should address all three domains to the greatest extent possible within the time and scope limitations of a particular tier. At a minimum, all STB education programs should achieve the following objectives:

- *Motivate* learners to act when faced with a hemorrhagic emergency (affective domain).
- Teach learners to *distinguish* life-threatening from non-life-threatening bleeding (cognitive domain).
- Teach learners to *apply pressure* (cognitive and psychomotor domains).

## CONTENT

The following are content recommendations for each specific tier of learners.

## Layperson Tier Content

### Motivate (affective)

Content in this learner domain must explain *why* hemorrhage control and STB education is important, while specifically empowering learners to take action to save a life. There are a number of possible ways to accomplish these tasks:

- Course designers can provide information about the battlefield experience that undergirds STB. Non-medically trained service members have saved many lives on battlefields in Iraq, Afghanistan and elsewhere, and this experience parallels the potential for the general public use STB to save lives.<sup>4,17</sup> Educators can provide context to their learners that, even though they are not service members, laypeople can provide similar lifesaving care.
- Educators can describe other public medical campaigns that have saved lives. For example, both cardiopulmonary resuscitation and choking education teach and empower laypeople to provide lifesaving care prior to professional medical help arriving.
- Course designers can provide information on the epidemiology of traumatic injuries, specifically that traumatic injury is the leading cause of death for people aged 1 year to 46 years.<sup>18</sup> They can share that life-threatening hemorrhage can kill within minutes, and that a layperson choosing to intervene may be the only difference between life and death for an injured person.
- Additional information can include the low likelihood of contracting communicable disease from blood exposure to intact skin, reassurance that a layperson is unlikely to cause additional harm, and applicable Good Samaritan laws.

### Distinguish (Cognitive)

Instructing laypeople about which wounds are appropriate for hemorrhage control, especially for tourniquet application, is one of the key objectives of STB training. Differentiating life-threatening from non life-threatening bleeding can be challenging, especially for laypeople with very limited prior exposure to life-threatening bleeding.

TABLE 1. Summary of SBEC Recommendations

Tier	Learner Description	Program Objectives and (Educational Domain)* <i>Applies to all tiers</i>	Education Design and Time (Minimum Elements)
Layperson	Non-medically oriented people General public with least likelihood of using material	<i>Motivate</i> learners to act when faced with a hemorrhagic emergency	Web-based** 15 min
Trained Layperson	Non-medically oriented people Public with greater motivation or need to know the material (i.e., law enforcement)	Teach learners to <i>distinguish</i> life-threatening from non life-threatening bleeding (cognitive)	Web-based† In-person skill practice One hour
Professional	Medical personnel	Teach learners to <i>apply pressure</i> (cognitive and psychomotor)	Web-based† In-person didactics In-person skills practice 2 hours

\*See manuscript text for a description of content recommendations for each tier. Each advanced tier adds additional content to the lower tier(s).

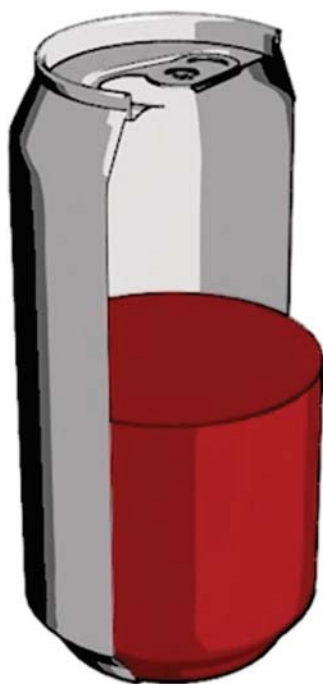
\*\*This includes mobile app or other widely accessible digital platform.

- Discuss only *volume* and *flow* of bleeding with learners in this tier. Volume of blood loss is difficult to estimate, so we recommend referencing half the volume of a standard liquid soda can to help (12-ounces in the United States, and approximately 330 ml in Canada, Europe and many other parts of the world). (Fig. 1) Teach learners that if that amount is present and bleeding continues, it could rapidly become life-threatening. The layperson should act immediately.
- In addition to *volume*, we recommend teaching laypeople about *flow*. If the flow of blood is continuous and steady, this can also represent life-threatening hemorrhage and the layperson should act immediately.
- The SBEC suggests against teaching additional concepts, such as determining the color of blood (bright red versus dark red), pulsatility, or specific injury patterns, as this may be confusing to learners and dilute the primary intent of delineating life-threatening from non life-threatening bleeding.

### Apply Pressure (cognitive and psychomotor)

The concept that *pressure* stops bleeding is the hallmark of STB. The STB logo shows an outstretched hand to emphasize that people can save a life by applying pressure with a hand<sup>1</sup> (Fig. 2). The SBEC's recommendations include:

- Apply firm, steady pressure.
- Wear gloves or other types of physical barriers when they are readily present. However, absence of gloves should NOT equal absence of action.
- Use hemostatic or medical gauze when available. If not, use available absorbable materials such as a shirt or a towel.



**Figure 1.** Layperson visual illustration of life threatening bleeding volume.



**Figure 2.** Stop the Bleed logo.

- Understand that tourniquets are devices that apply a type of *pressure* that is appropriate for life-threatening bleeding in arms or legs.
- Tourniquets should be considered first-line treatment for life-threatening extremity bleeding.
- An effective commercial tourniquet should be used, as they are more successful than improvised tourniquets.
- If no tourniquet is available, the layperson should apply direct pressure.
- Understand how to apply a windlass rod tourniquet. While the underlying science to recommend one particular tourniquet type versus another is weak, windlass rod tourniquets are the most commonly available and the best described to date in military literature.<sup>19</sup>
- Apply the tourniquet above the wound (between the wound and the torso). It is important to emphasize that the tourniquet should be applied between the wound and torso, as a common reason for misapplication by laypeople is placing the tourniquet directly on top of the wound.<sup>20,21</sup>
- Tighten the tourniquet until bleeding stops and secure the windlass rod in the clip of the device. Not tightening the device until bleeding stops is a common reason for failed layperson tourniquet application.<sup>20,21</sup> The *pull, twist, clip* mantra is a simple way to remember the steps (i.e. pull the strap, twist the rod and clip the rod).
- Anticipate that tourniquet application will be painful for the bleeding person. The layperson should continue tightening the tourniquet, despite the pain it causes, until bleeding stops, and then leave the tourniquet in place until evaluated by medical personnel.
- If life-threatening bleeding continues, apply a second tourniquet above (closer to the torso) the original tourniquet, while leaving the original tourniquet in place. If an additional tourniquet is not available, apply direct pressure to the wound.

### Additional Content

In addition to the above key points, the SBEC recommends including the following information:

- Direct the layperson to tell someone else to call 9-1-1, while the layperson starts applying pressure to stop bleeding. If the layperson is alone but has a mobile phone, he or she should use the speaker function of the phone to dial 9-1-1 while applying pressure.
- A recommendation to contact a health care provider to discuss any concerns about body fluid exposure.



- The layperson tier should include referrals to trained layperson resources as encouragement to obtain additional training.
- Hemostatic dressings are more effective than plain gauze for hemorrhage control, as evidenced by combat casualty care research.<sup>22</sup> However, there are many types of hemostatic dressings available, and they can be expensive and challenging to use correctly. We think it may be difficult to teach the technical skills necessary to pack hemostatic dressings appropriately into a wound with the brief exposure of the layperson tier. Moreover, such focus on hemostatic dressings could dilute the primary message of using pressure to stop bleeding. It would still be reasonable to tell laypeople that hemostatic dressing can be substituted for plain gauze when available, and applied in the same manner as plain gauze. Further research demonstrating laypeople's ability to use hemostatic dressings could alter this SBEC recommendation.

### Trained Layperson Tier Content

The SBEC recommends that the trained layperson tier include all content described in the layperson tier above. In addition, it should include the following content.

#### Hemostatic Dressings

The SBEC recommends teaching hemostatic dressing use to the trained layperson and professional tiers. The SBEC recommends selecting a single hemostatic dressing and teaching learners to use it. The specific dressing may vary depending upon ones used in a certain area (for example, if instructing a police unit, teach the type of hemostatic dressing stocked in the unit's first aid kits). Some personal and public access bleeding control kits may not include hemostatic dressings. However, it is reasonable to expect that a trained layperson should use a hemostatic dressing when available. The overriding concept that should be emphasized is that pressure stops bleeding.

#### Improvised Tourniquets

As discussed in the layperson tier, evidence suggests that improvised tourniquets are inferior to the performance of commercial tourniquets, and may not be more effective than no tourniquet at all.<sup>19</sup> However, for specific learner groups in the trained layperson tier, such as wilderness first aid students, it may be appropriate to consider teaching about improvised tourniquets. It should be clear to learners that commercial tourniquets are preferred. In the absence of a commercial tourniquet, direct pressure should be used. An improvised tourniquet should be considered for extenuating circumstances, such as the need for a layperson to stop applying pressure and use their hands to help evacuate an injured person from a wilderness area.

### Professional Tier Content

The professional tier should include all content described in the trained layperson tier. In addition, the SBEC recommends this tier include the following content:

#### Hemostatic Dressings

Health care professionals should be exposed to a variety of types of hemostatic dressings, and taught how to use them.

### Pathophysiology

Basic concepts about hemorrhagic shock should be taught to this learner population and tailored, depending on the knowledge level of the specific learner group.

### Professional Responsibility

The duty to respond differs between laypeople and health care professionals, and it should be clear that professionals generally have a duty to respond to bleeding that laypeople do not have.

### Nuanced Discussions

Both the layperson and trained layperson tiers should, as much as possible, avoid nuanced discussions and anecdotes that can be confusing to learners. The focus is on simple, clear messaging. In the professional tier, however, it may be appropriate to discuss more nuanced topics like multiple responder versus single responder scenarios and when and how to consider removing a tourniquet. Professionals must also be taught how to appropriately communicate the type of injury and treatments to the next level of care.

## EDUCATIONAL DESIGN

With the key content elements identified for each tier, it is equally important to consider the delivery mechanisms. The SBEC recommends the following:

### Layperson Tier Design

This training should be provided in a widely available, digital format, such as a website or mobile application. The training should be designed as an asynchronous platform that can be viewed in a brief timeframe. Previous research shows that very brief (just-in-time) education can facilitate layperson success in applying a tourniquet.<sup>20,21</sup> Ideally, training in this tier would be completed within approximately 15 minutes. This limited length of time is likely to keep laypeople engaged, and provides baseline training to augment just-in-time instruction found in bleeding control kits at the point of injury.<sup>20,21</sup> This recommendation specifically does not discourage educators from adjunctive in-person training, but recognizes that Web-based training will be much more readily available and potentially sufficient for this learner population.

### Trained Layperson Tier Design

This training should incorporate both Web-based training as well as an in-person component. The in-person component should reinforce materials of the Web-based training and allow for supervised skills practice with instructors. Direct pressure, hemostatic dressing application, and tourniquet application should be practiced. This course should take one hour or less, and ensure all participants have the opportunity to demonstrate competency with the bleeding control skills.

### Professional Tier Design

This training should contain robust in-person training, while using Web-based training as an adjunct. The in-person session should allow time for practice with multiple hemostatic dressings and tourniquets as well as scenario-based situations

that require greater decision-making. This course should take 2 hours or less.

## ASSESSMENTS

We recommend two different types of programmatic assessment measures: outcomes and process.

Outcome measures are the ideal measurement for an STB educational program. Specifically, if a program is able to demonstrate lives saved, or appropriate tourniquet applications directly related to its program, this becomes compelling information in supporting an STB program. However, we acknowledge that this will be difficult for an individual training program to demonstrate. Multisite studies among multiple training programs could help mitigate these challenges. Lower-level outcomes, such as pre- and post-knowledge testing, or knowledge retention studies, may be necessary as surrogates.<sup>23</sup>

In addition to outcomes, programs can consider process measures. These will be much easier to obtain, though not as meaningful as outcome measures. For example, programs can look at the number of people trained, learners' assessment of the program, demographics of people trained (occupations, ages, etc.).

Individual learner assessments may be necessary in addition to programmatic assessments. These will vary by tier.

### Layperson Tier Assessment

The SBEC recommends considering a quiz with approximately 10 questions designed as a formative, rather than summative, experience for the learner. Any quiz should consider unique language and cultural needs of the learner audience.

### Trained Layperson Tier Assessment

Learners should have to demonstrate both knowledge and skills to acquire a completion certificate or card. This assessment would ideally be scenario based, allowing an instructor to assess both knowledge and skills at the same time. If this is not feasible due to resources, an electronic or pen-and-paper knowledge examination accompanied by skill demonstration may also be acceptable.

### Professional Tier Assessment

A more comprehensive knowledge and skill assessment reflecting the additional content will be necessary.

## CONCLUSIONS

Stop the Bleed has the potential to bring lifesaving hemorrhage control knowledge to the general public as well as reinforce essential priorities and actions to health care professionals. Educational programs that motivate laypeople to action, teach them to distinguish life-threatening from non life-threatening bleeding, and emphasize that pressure stops bleeding can save lives, thereby realizing the STB campaign's goals. Beyond saving individual lives, this layperson education may help build public resilience that could pay dividends when our nation faces tragedy. The SBEC hopes this article's recommendations help educators identify content, curriculum design and assessment

appropriate for the recommended three learner tiers of STB education programs.

## AUTHORSHIP

C.G. and T.K. created and organized the Stop the Bleed Education Consortium (SBEC). All authors participated in SBEC consensus planning calls to develop the guidelines in this paper. C.G. authored the first draft, and all authors reviewed a series of drafts and made inputs and/or edits.

## DISCLOSURE

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## REFERENCES

1. Rasmussen TE, Baer D, Goolsby C. The giving back: battlefield lesson to national preparedness. *J Trauma Acute Care Surg*. 2016;80(1):166–167.
2. JEMS Staff. What the White House's Stop the Bleed Campaign Means for EMS. Available at: <http://www.jems.com/articles/print/volume-41/issue-40/special-focus-gearing-up-for-active-shooter-tactical-high-threat-incidents/what-the-white-house-s-stop-the-bleed-campaign-means-for-ems.html>. Accessed June 3, 2017.
3. Department of Homeland Security. Stop the Bleed. Available at: <http://www.dhs.gov/stopthebleed>. Accessed July 1, 2017.
4. Blackburne LH, Baer DG, Eastridge BJ, Kheirabadi B, Kragh JF Jr, Cap AP, Dubick MA, Morrison JJ, Midwinter MJ, Butler FK, et al. Military medical revolution: Prehospital combat casualty care. *J Trauma Acute Care Surg*. 2012;73(6):S372–S377.
5. Jacobs LM Jr. Joint Committee to Create a National Policy to Enhance Survivability from Intentional Mass-Casualty and Active Shooter Events. Hartford Consensus III: implementation of bleeding control—if you see something do something. *Bull Am Coll Surg*. 2015;100(7):20–26.
6. Jacobs LM, Wade D, McSwain NE, Butler FK, Fabbri W, Eastman A, Conn A, Burns KJ. Hartford Consensus: a call to action for THREAT, a medical disaster preparedness concept. *J Am Coll Surg*. 2014;218(3):467–475.
7. National Academies of Sciences, Engineering, and Medicine. *A National Trauma Care System: Integrating Military and Civilian Trauma Systems to Achieve Zero Preventable Deaths after Injury*. Washington, DC: The National Academies Press; 2016.
8. Rasmussen TE, Kellermann AL. Wartime lessons—shaping a National Trauma Action Plan. *N Engl J Med*. 2016;375(17):1612–1615.
9. American Colleges of Surgeons. Available at: <http://www.bleedingcontrol.org>. Accessed July 1, 2017.
10. Einspruch EL, Lynch B, Aufderheide TP, Nichol G, Becker L. Retention of CPR skills learned in a traditional AHA Heartsaver course versus 30-min video self-training: a controlled randomized study. *Resuscitation*. 2007;74(3):476–486.
11. Smith KK, Gilcreast D, Pierce K. Evaluation of staff's retention of ACLS and BLS skills. *Resuscitation*. 2008;78:59–65.
12. Chalkias A, Antoniou P, Xanthos T. Education in resuscitation: the need for a new teaching method. *Am J Emerg Med*. 2017;35(2):370–371.
13. Mahony PH, Griffiths RF, Larsen P, Powell D. Retention of knowledge and skills in first aid and resuscitation by airline cabin crew. *Resuscitation*. 2008;76(3):413–418. Epub 2007 Oct 31.
14. Anderson GS, Gaetz M, Masse J. First aid skill retention of first responders within the workplace. *Scand J Trauma Resusc Emerg Med*. 2011;19:11.
15. Kern D, Thomas P, Hughes M. *Curriculum Development for Medical Education: A Six-Step Approach*. 2nd ed. Baltimore, MA: The Johns Hopkins University Press; 2009.

16. Bastable S, Gramet P, Jacobs K, Sopczyk D. *Health Professional as Educator: Principles of Teaching and Learning*. Jones & Bartlett Learning, LLC: Sudbury; 2011.
17. Kotwal RS, Montgomery HR, Kotwal BM, Champion HR, Butler FK, Mabry RL, Cain JS, Blackburne LH, Mechler KK, Holcomb JB. Eliminating preventable death on the battlefield. *Arch Surg*. 2011;146(12):1350–1358.
18. Levy MJ, Jacobs LM. A call to action to develop programs for bystanders to control severe bleeding. *JAMA Surg*. 2016;151(12):1103–1104.
19. Kragh JF Jr, Dubick MA. Bleeding control with limb tourniquet use in the wilderness setting: review of science. *Wilderness Environ Med*. 2017;28(2S):S25–S32.
20. Goolsby C, Chen E, Branting A, Weissbrod E, David J, Moore K, Olsen C. Analysis of layperson tourniquet application using a novel color-coded device. *Disaster Med Public Health Prep*. 2016;10(2):274–280.
21. Goolsby C, Branting A, Chen E, Mack E, Olsen C. Just-in-time to save lives: a pilot study of layperson tourniquet application. *Acad Emerg Med*. 2015;22(9):1113–1117.
22. Bennett BL, Littlejohn L. Review of new topical hemostatic dressings for combat casualty care. *Mil Med*. 2014;179(5):497–514.
23. Kirkpatrick DL, Kirkpatrick JD. *Evaluating Training Programs*. San Francisco, CA: Berrett-Koehler Publishers, Inc.; 1994.