

Assessing Efficacy of *Stop the Bleed* Education

ABSTRACT

Stop the Bleed is a national grassroots, education campaign effort that focuses on empowering the public to recognize and control life-threatening bleeding emergencies. The White House, Homeland Security, and the American College of Surgeons - Committee on Trauma, and the Hartford Consensus have endorsed the program since 2015. *Stop the Bleed* is a call to action plan to train the public on hemorrhage recognition and control until medical personnel are available for management. An additional initiative is to place bleeding control kits in every public place. This project focused on educating 80-100 professionally trained and lay persons utilizing handouts and presentation information provided by the *Stop the Bleed* campaign. The education process involved the use of material focused on hemorrhage recognition while the second component of training involved active and return demonstration of tourniquet use, wound packing with gauze, and hemostatic agents for major bleeding control. A retrospective study evaluating pre and post questionnaires was utilized to assess knowledge of bleeding control education. The goal of this project was to prove that the *Stop the Bleed* campaign initiative can effectively train individuals regardless of current knowledge level. The significance of this study is to prove efficacy and support training of the public in responding to natural and unintentional disasters that result in uncontrolled bleeding.

Key Words: *hemorrhaging, stop the bleed, bleeding control*

1. INTRODUCTION

According to the World Health Organization, 5.8 million people die annually as a result of injuries.¹ Mortality from hemorrhage after trauma ranges from 30% to 40% with 33% to 56% of those hemorrhaging expiring during the prehospital period.² Depending on which blood vessels are affected a person can bleed to death as quickly as two to three minutes.³ Educating the public on hemorrhage control improves self-reported willingness to assist in bleeding emergencies.⁴ Moreover, studies have indicated that in-person hemorrhage control training for laypersons is the most efficacious way to enable bystanders in assisting with bleeding emergencies.⁵ The purpose of this project was to evaluate efficacy of established *Stop the Bleed* in-person education among professionally trained and laypersons.

Mass casualty incidents in recent history illustrate the importance of hemorrhage control education. Over the past 10 years, the U.S. has experienced 18 of the deadliest mass shootings in its history.⁶ It is estimated that 113,108 people are shot each year in the U.S. and 36,383 persons shot die from their injuries.⁷ In 2016, motor vehicle crashes took the lives of 37,461 people in the U.S.⁸ Mass casualty incidents are not limited to the U.S. Globally, mass shootings have affected thousands of victims with the most recent attack occurring the Al Noor Mosque in Christchurch, New Zealand and resulting in 51 fatalities.⁹ These and other incidents such as the 2015 Amtrak train derailment that killed eight people and

injured hundreds more demonstrate the high potential of public exposure to uncontrolled bleeding and the need for efficacious hemorrhage control education.¹⁰

1.1 Significance

Literature evaluating efficacy of Stop the Bleed education is scant and focuses primarily on a person's confidence and willingness to assist in bleeding emergencies. In a recent study an individual's self-efficacy and willingness to use a tourniquet pre and post *Stop the Bleed* education were evaluated.⁴ Results indicated a statistically significant improvement in self-efficacy and willingness to use a tourniquet after *Stop the Bleed* education. Of note, persons with "formal medical certification" were excluded from this study.⁴ The Iowa Department of Public Health in collaboration with the American College of Surgeons Committee on Trauma, Iowa Chapter and the Trauma Systems Advisory Council implemented *Stop the Bleed* statewide in the summer of 2017.¹¹ Student evaluations of the program were provided, but focused on self-efficacy and willingness to assist in bleeding emergencies.¹¹ Currently, there is no publically available published data from the Iowa Department of Health on student evaluations of *Stop the Bleed*.

1.2 Aim

The aim of this project was to assess efficacy of *Stop the Bleed* education in improving knowledge of hemorrhage control among professionally trained and laypersons. The researchers hypothesized that implementation of *Stop the Bleed* education would significantly improve knowledge of hemorrhage control in both groups.

2. METHODS

A 10-item questionnaire was developed by the researchers (Appendix A). The questionnaire was designed to evaluate an individual's knowledge of hemorrhage control in bleeding emergencies. Each researcher recruited two associates, one medical professional to address content validity and one layperson (similar to the targeted research population) to address face validity. Reviewers were asked to respond to specific questions about clarity, readability, length, and recommendations to improve each section of the questionnaire. Suggestions from reviewers were incorporated and a final draft was sent to the same associates for final review and approval.

The questionnaire was distributed to persons attending planned *Stop the Bleed* education at locations throughout the state of Louisiana during the months of October and November of 2018. Locations included state nursing conferences and industrial companies within the southeast region of Louisiana. Questionnaires, labeled "Pre-Questionnaire" were distributed to participants prior to beginning *Stop the Bleed* education, which includes approximately 20 minutes of didactic instruction and a "hands on" demonstration/return demonstration portion. The same questionnaire, labeled "Post-Questionnaire" was distributed once *Stop the Bleed* education was completed. All questionnaires were submitted anonymously into a locked box and contained no information that allowed for identification of survey participants. Data was not analyzed until all *Stop the Bleed* education had been completed.

The researchers discussed the purpose of the questionnaires with persons participating in *Stop the Bleed* education. If *Stop the Bleed* participants were interested in participating in the study a consent form was given to them to review prior to participation. Once interested participants reviewed the consent, pre *Stop the Bleed* education questionnaires were distributed. Participants were able to refuse to complete the questionnaire(s) prior to beginning or discontinue participation at any time during the study without bias or repercussion from the principle investigators. This was explicitly stated on the participant consent form. To ensure protection of human subjects and ethical research, all researchers and assistants involved in this project completed Human Subjects Training via the Collaborative Institutional Training Initiative and obtained Internal Review Board approval from the University of Louisiana at Lafayette prior to implementing the project.

2.1 Protection of Human Subjects

To ensure protection of human subjects and ethical research, all researchers and assistants involved in this project completed Human Subjects Training via the Collaborative Institute Training Initiative. Each participant was provided with a consent form prior to participating in this study. If there were any questions or concerns related to consent the primary investigator was available to address them. To ensure anonymity of participants pre and post *Stop the Bleed* questionnaires did not include any identifying information. All questionnaires were placed in a locked box that was not accessed until all data had been collected.

The only potential risk to participants was loss of time used to complete the pre and post *Stop the Bleed* questionnaires as well as the *Stop the Bleed* education program. However, potential individual benefit was robust in that persons participating in *Stop the Bleed* education obtained vital information about hemorrhage control. This not only benefits the individual, but the general public as well. Participants also had the opportunity to become *Stop the Bleed* certified instructors. Finally, evaluation of the *Stop the Bleed* program assessed its efficacy and determined if there is a need for a more detailed educational intervention.

3. RESULTS

Descriptive statistics were run on all questions and pre and post total scores for both professionally trained and layperson's groups (Tables 1 & 2). Overall mean scores for every question demonstrated significant improvement between pre and post questionnaires in both groups. In the professionally trained group ($n = 89$) the pre questionnaire mean score was a 3.96 as opposed to the post questionnaire mean score of an 8.81. In the laypersons group ($n = 57$) the pre questionnaire mean score was a 3.84 as opposed to the post questionnaire score of a 7.89.

A repeated measures ANOVA was conducted to assess if significant differences existed among pre and post questionnaire total scores in both groups. For the professionally trained group the results of the ANOVA were significant, $F(1, 88) = 476.69$, $p < .001$, indicating there were significant differences among the values of the pre questionnaire results and post questionnaire results. For the laypersons group the results of the ANOVA were significant, $F(1, 56) = 223.23$, $p < .001$, indicating there were significant differences among the values of pre questionnaire results and post questionnaire results.

Table 1. *Stop the Bleed* professionally trained results ($n = 89$)

	Mean	SD	Skewness	Kurtosis
Pre Q1	0.27	0.45	1.04	-0.92
Post Q1	0.99	0.11	-9.27	84.01
Pre Q2	0.38	0.49	0.49	-1.76
Post Q2	0.72	0.45	-0.97	-1.05
Pre Q3	0.25	0.43	1.17	-0.63
Post Q3	0.80	0.40	-1.48	0.2
Pre Q4	0.25	0.43	1.17	-0.63
Post Q4	0.94	0.23	-3.85	12.68
Pre Q5	0.10	0.30	2.65	5.00
Post Q 5	0.55	0.50	-0.20	-1.96
Pre Q6	0.72	0.45	-0.97	-1.05
Post Q6	0.92	0.27	-3.13	7.80
Pre Q7	0.80	0.40	-1.48	0.20
Post Q7	0.97	0.81	-5.17	24.70
Pre Q8	0.36	0.48	0.59	-1.66
Post Q8	0.98	0.15	-6.44	39.52
Pre Q9	0.15	0.36	2.00	2.02
Post Q9	0.98	0.15	-6.44	39.52
Pre Q10	0.70	0.46	-0.86	-1.27
Post Q10	0.98	0.15	-6.44	39.52
Pre Total	3.96	1.71	0.52	0.14
Post Total	8.81	1.11	-1.08	1.06

Table 2. *Stop the Bleed* laypersons results (n = 57)

	Mean	SD	Skewness	Kurtosis
Pre Q1	0.51	0.50	-0.04	-2.00
Post Q1	0.96	0.19	-0.505	23.54
Pre Q2	0.18	0.38	1.71	0.91
Post Q2	0.49	0.50	0.04	-2.00
Pre Q3	0.07	0.26	3.37	9.33
Post Q3	0.65	0.48	-0.62	-1.61
Pre Q4	0.11	0.31	2.57	4.62
Post Q4	0.91	0.29	-2.91	6.50
Pre Q5	0.11	0.31	2.57	4.62
Post Q 5	0.19	0.40	1.56	0.42
Pre Q6	0.60	0.49	-0.39	-1.85
Post Q6	0.98	0.31	-2.57	4.62
Pre Q7	0.75	0.43	-1.18	-0.60
Post Q7	0.96	0.19	-5.05	23.54
Pre Q8	0.54	0.05	-0.18	-1.97
Post Q8	0.88	0.33	-2.30	3.82
Pre Q9	0.14	0.35	2.07	2.29
Post Q9	0.98	0.13	-7.35	52.02
Pre Q10	0.82	0.38	-1.71	0.91
Post Q10	1	0	-	-
Pre Total	3.84	1.39	-0.28	-0.07
Post Total	7.89	1.36	-0.50	0.18

4. DISCUSSION

Summative assessment of *Stop the Bleed* education in improving knowledge of hemorrhage control has not been previously implemented. Evaluation tools have focused on participants' self-efficacy and willingness to assist in a bleeding emergency. However, prior to implementation of *Stop the Bleed*, the general public already demonstrated a desire to help bleeding victims.¹²

A more stringent evaluation process is needed to ensure *Stop the Bleed* participants are obtaining the knowledge required to effectively control bleeding emergencies. While results for this study indicated an overall improvement in knowledge of hemorrhage control among professionally trained and laypersons after *Stop the Bleed* education, future research could focus on establishing a consistent summative assessment tool that can be used with multiple populations.

5. CONCLUSION

Stop the Bleed was efficacious in improving knowledge of hemorrhage control in these cohorts of professionally trained and laypersons; however, due to lack of reliability data on the pre/post questionnaire in this study the authors suggest that further research needs to focus on determining that this questionnaire is a reliable instrument. The authors also suggest utilizing tools such as pre and post knowledge and self-efficacy questionnaires to ensure objectives of *Stop the Bleed* education are achieved. *Stop the Bleed* education of professionally trained and laypersons is critical to improving mass casualty survival outcomes.

REFERENCES

1. World Health Organizaton. Injuries and violence: the facts. https://www.who.int/violence_injury_prevention/key_facts/en/
2. Kauvar DS, Lefering R, Wade CE. Impact of hemorrhage on trauma outcome: an overview of epidemiology, clinical presentations, and therapeutic consideration. *J Trauma*. 2006;60(6):S3-11.

3. U. S. Department of Homeland Security. Survivability in improvised explosive device and/or active shooter incidents. <https://www.dhs.gov/sites/default/files/publications/First%20Responder%20Guidance%20June%202015%20FINAL%202.pdf>. Published June, 2015. Accessed November 2, 2018.
4. Ross EM., Redman TT, Mapp JG, Brown DJ. Stop the bleed: the effect of hemorrhage control education on laypersons' willingness to respond during a traumatic medical emergency. *Prehosp Disaster Med*. 2018;33(2):127-132.
5. Goralnick E, Chaudhary MA, McCarty JC, et al. Effectiveness of instructional interventions for hemorrhage control readiness for laypersons in the public access and tourniquet training study (PATTs): a randomized clinical trial. *JAMA*. 2018;153(9):791-799.
6. Willingham AJ, Ahmed S. Mass shootings in America are a serious problem and these 9 charts show just why. Cable News Network. November 6, 2012. <https://www.cnn.com/2016/06/13/health/mass-shootings-in-america-in-charts-and-graphs-trnd/index.html>. Accessed November 2, 2018.
7. Brady Campaign. Key gun violence statistics. <http://www.bradiycampaign.org/key-gun-violence-statistics>. Updated 2019. Accessed May 22, 2019.
8. Insurance Institute for Highway Safety Highway Loss Data Institute. General statistics:2016. <https://www.iihs.org/iihs/topics/t/generalstatistics/fatalityfacts/overview-of-fatality-facts>. Updated December, 2017. Accessed November 2, 2018.
9. The deadliest mass shootings in history. <https://www.worldatlas.com/articles/the-deadliest-mass-shootings-in-history.html>. Updated 2019. Accessed May 22, 2019.
10. 8 dead, more than 200 injured following Philadelphia train derailment. CBS Philly. May 18, 2015. <https://philadelphia.cbslocal.com/2015/05/12/crews-responding-to-reported-train-derailment-in-port-richmond/>. Accessed November 2, 2018.
11. Iowa Department of Public Health. About stop the bleed campaign. <https://idph.iowa.gov/bets/stop-the-bleed>. Updated 2018. Accessed November 2, 2018.
12. Jacobs LM, Burns KJ, Langer G, Kiewiet de Jonge C. The Hartford Consensus: a national survey of the public regarding bleeding control. *J Am Col Surg*. 2016;222(5): 948–955

APPENDIX

Pre/Post Questionnaire

1. When addressing the ABCs of bleeding control, what does the A stand for in emergency response?
 - a. Airway
 - b. Attention to bleeding person
 - c. Alert
2. What is the first response to a victim who has a bleeding emergency?
 - a. Call 911
 - b. Find the bleed site/injury
 - c. Ensure safety
 - d. Apply pressure to stop bleeding
3. After calling 911 in a bleeding emergency, what is the next appropriate action?
 - a. Apply pressure to the bleeding area
 - b. Remove clothing to assess the wound
 - c. Get a bleeding control kit that contains materials for bleeding control
4. Bleeding from which of the following sites has the best chance of survival?
 - a. A victim bleeding from an arm wound
 - b. A victim bleeding from a leg wound
 - c. A victim bleeding from a shoulder wound
 - d. All of the above
 - e. A and B only
5. Which of the following bleeding sites should not be stopped outside of the hospital and requires rapid transportation?
 - a. Groin wound
 - b. Abdominal wound
 - c. Chest wound
 - d. Neck wound
 - e. B and C
 - f. All of the above
6. Which of the following is true when applying direct pressure to a bleeding wound?
 - a. Use 2 finger or hands to apply pressure
 - b. Maintain pressure until medical responders arrive to the scene
 - c. Direct pressure can stop an arterial bleed
 - d. Release pressure periodically to make sure there is no further injury to the limb
 - e. All of the above
 - f. A, B and C only
7. In regards to military approved tourniquets, which of the following is true?
 - a. Used to stop bleeding in arm and leg wounds
 - b. Tighten until bleeding stops
 - c. Place 2- 3 inches above the bleeding site
 - d. All of the above
8. Proper tourniquet placement may produce pain in the applied extremity and is tightened until the extremity has no pulse.
 - a. True

254 b. False

255
256 9. How long can a tourniquet remain on a limb?

257 a. 30 minutes

258 b. 1 hour

259 c. 2 hours

260 d. 3 hours

261
262 10. If I approached a life threatening bleeding emergency, I know what to do?

263 a. Yes

264 b. No

UNDER PEER REVIEW