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Efficacy of Healthcare Student-Led Stop the Bleed Training for Middle School Students

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Abstract

Objective: Increase bleeding control knowledge and self-efficacy among middle school students and determine efficacy of health care student-led Stop the Bleed (STB) training.

Methods: An interprofessional group of health care students led STB trainings at 6 Texas middle schools. Trainings included a presentation plus hands-on skills training and were evaluated using pre- and post-training surveys focused on bleeding control knowledge, self-efficacy, and willingness to assist in emergencies. Paired pre- and post-training survey responses were compared using McNemar's test for knowledge-based questions and paired *t* tests for Likert scale responses.

Results: Health care students ($N = 103$) trained 805 middle school students, aged 10-16 years, of which 447 (55.5%) completed pre- and post-surveys. There was significant improvement in all 7 knowledge-based questions from pre- to post-training. There were significant improvements in comfort using tourniquets (median [interquartile range]: 3 [2-4] vs. 4 [3-5]; $P < 0.0001$), confidence applying direct pressure (3 [2-4] vs. 4 [3-5]; $P < 0.0001$), and likeliness to assist someone bleeding (4 [3-5] vs. 4 [4-5]; $P = 0.0096$). Eighty-four percent of students found this training "useful."

Conclusions: While previous studies have demonstrated STB training efficacy, this is among the first to provide evidence that health care student-led STB training significantly increased bleeding control knowledge and self-efficacy among middle school students.

Traumatic injury represents a significant health burden among adolescents, accounting for 25% of deaths among those aged 10-19 years globally in 2019.[1] In the US, injury is the leading cause of death for children and adolescents, accounting for more fatalities than all other causes combined, despite many bleeding-related fatalities being preventable.[2] Unfortunately, a rising number of fatalities are due to firearm-related injuries. In 2022, there were 304 firearm-related incidents at kindergarten-12th grade schools, a 22% increase from 2021, emphasizing the dire need for immediate and effective response measures.[3]

In response to rising firearm-related injuries and gun violence, the Department of Defense, in collaboration with the American College of Surgeons (ACS), launched the Stop The Bleed® (STB) campaign in October 2015. STB teaches the public essential bleeding control skills, including life-threatening bleeding recognition, pressure application, wound packing, and tourniquet application.[4]

Though STB efficacy is well-documented in adult populations,[5] there is limited research regarding younger populations. Of the studies detailing bleeding control training in adolescents, most have focused on high-school-aged students or utilized non-STB training methods.[6–8] Research evaluating STB training led by health care students is also lacking.

This study was conducted to assess the efficacy of health care-student-led STB training in middle school students and to determine whether the program can be broadly adopted for use in this group.

Methods

Study Design and Population

This quasi-experimental study with a 1-group pretest/posttest design was conducted between 2022 and 2023 among students enrolled in 6 public middle schools in San Antonio,

Texas. Two schools requested repeat trainings the following year; thus, a limited number of students participated twice but were asked not to complete a survey the second year. This study was reviewed by The University of Texas Health San Antonio Institutional Review Board and deemed non-regulated research (IRB #20220619NRR).

STB Trainers

In total, 103 health care student volunteers from medical, pharmacy, dental, physical therapy, occupational therapy, physician assistant, and nursing programs from 3 local universities attended 1 of 7 trainings to become certified associate STB instructors. In addition, 3 medical students with National Registry of Emergency Medical Technicians (NREMT) certification and several pharmacy faculty were certified as lead STB instructors.

STB Training

The STB training course is a standardized program, consisting of a 30-minute didactic presentation and a 30-minute hands-on skills training. Medical students, certified as lead STB instructors, conducted the didactic portion, using a slideshow provided by STB. Materials for the hands-on skills training (e.g., tourniquets, artificial limbs with wounds, gauze), were loaned from University Hospital and the Southwest Texas Regional Advisory Council. A limited number of the 103 health care student volunteers attended each middle school event. During the skills training, each health care student volunteer demonstrated pressure application, wound packing, and tourniquet application to a small group of middle school students (≤10:1 student-to-instructor ratio). Following the demonstration, each middle school student practiced these skills while being observed by the instructor, who would assist as needed. Pharmacy faculty were also present to observe and assist.

To increase community impact, student-led grants were obtained, enabling the distribution of 141 bleeding control kits to participating schools. Each kit consisted of a combat application tourniquet, gauze, scissors, a marker, a chest seal, and gloves.

Pre- and Post-training Surveys

Training efficacy was evaluated with pre- and post-training surveys (Online Data Supplement). Participants were de-identified by assigning each student a random numeric code, which was used to match pre- and post-training surveys. Both electronic and paper surveys were made available in English and Spanish. STB trainers assisted students who had difficulty with translation or reading as needed.

The survey originated from previously published research that assessed the efficacy of STB training in adults.[9–10] The language of several questions was adapted to improve accessibility for an adolescent population without altering the fundamental meaning of the questions. The survey collected information regarding demographics, knowledge of bleeding control techniques, comfort and confidence using those techniques, willingness to respond during a traumatic event, and concerns regarding emergency response. Knowledge-based questions included yes/no and true/false questions, and 2 body diagrams with marked wounds were used to assess proper tourniquet placement. Comfort, confidence and willingness to use bleeding control techniques were assessed with 5-point Likert scales. Lastly, the post-training survey asked each student to rank the training as not useful, neutral, or useful.

Statistical Analysis

Only paired surveys were included (i.e., students completing only 1 of the 2 surveys were excluded). However, surveys missing responses to 1 or more questions were included. For example, if a student completed both the pre- and post-training survey but chose not to answer 1 question on the pre-training survey and 2 questions on the post-training survey, they were still included in the analysis. Thus, each question may have a different sample size. All responses to knowledge-based questions were recorded as a binary variable (i.e., correct/incorrect), and McNemar's test was used to compare the proportion of "correct" responses between the pre- and post-training surveys. Differences in Likert scale responses between pre- and post-training surveys were evaluated utilizing a paired t-test. All P values were from 2-sided tests, and a $P < 0.05$ was considered statistically significant. All statistical analyses were performed using STATA, version 15.1 (StataCorp LLC, College Station, TX) and data were visualized using the "ggplot2" package in R, version 3.6.1 (The R Foundation for Statistical Computing, Vienna, Austria).

Results

In total, 805 middle school students attended a health care student-led STB training across 2 school years. Of those, paired pre- and post-training surveys were completed by 447 (55.5%) students: 179 from 3 schools in 2022 and 268 from 5 schools in 2023. The mean respondent age was 12.2 years (standard deviation 1.0), and 58.7% identified as male, 39.7% female, and 1.6% other.

Pre- and post-training survey question comparisons can be found in Table 1 and Figure 1. Student knowledge significantly improved for all 7 questions after training. The students' comfort, confidence, and willingness to respond to a bleeding event also improved after training, with mean pre- and post-training survey responses significantly different for all 5 Likert scale questions. Overall, 84.3%, 12.5%, and 3.1% of students expressed that they found the training session useful, neutral, or not useful, respectively.

Students were also asked to select 1 or more concerns they might have when attempting to help a bleeding person. The most common concerns documented in pre-training surveys were fear of making a mistake (66.2%), not wanting to hurt someone (49.4%), not knowing how to help (32.4%), feeling there are better people to help (28.0%), and not liking blood (12.1%). After the training, significantly fewer students were concerned about hurting someone (43.9%, $P = 0.03$) and not knowing how to help (14.8%, $P < 0.0001$), while the other concerns did not significantly change. The proportion of students that chose at least 1 reason why they may be less likely to help a bleeding person decreased from 95.3% to 90.8% after training ($P = 0.0003$).

Discussion

To the authors' knowledge, this study represents the first report demonstrating that interprofessional, health care student-led STB training significantly improved knowledge, self-efficacy, and bleeding control skills among middle school students. Previous studies provided insight regarding STB or other bleeding control training modalities in adolescents, generally demonstrating such activities efficacious. Sidwell et al. taught middle school students bleeding control skills and assessed the efficacy of the training using objective skill measures and a pre/post survey.[8] They

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Table 1. Student Survey Responses

Proportion of students who correctly answered knowledge questions				
Survey Question Number	Survey Question Text	Correct Pre-training Responses (%)	Correct Post-training Responses (%)	*P*-value
1	Do you know what a tourniquet is?	27.8	95.3	**<0.0001**
2	True or false: Tourniquets are hard to use	61.9	77.8	**<0.0001**
3	True or false: Tourniquets are a good way to stop bleeding on the legs or arms	88.7	94.6	**0.0006**
4	True or false: Tourniquets should be placed above a wound	69.5	76.2	**0.02**
5	True or false: Tourniquets should only be left on someone for 1 hour	59.9	72.1	**<0.0001**
6	On the image below, choose where you would place a tourniquet on the leg if the spot marked with an 'X' was bleeding*	56.5	65.6	**0.003**
7	On the image below, choose where you would place a tourniquet on the arm if the spot marked with an 'X' was bleeding*	59.0	68.0	**0.0008**

Student responses to Likert scale questions that assessed their comfort using bleeding control techniques, confidence in their skills, and willingness to help someone with a life-threatening bleed						
Survey Question Number	Survey Question Text	Likert Scale Choices	Number of Paired Surveys, *N*	Pre-training Responses, median (IQR)	Post-training Responses, median (IQR)	*P*-value
8	How confident are you that you know how to correctly apply pressure to control severe bleeding?	1 – Very Unconfident 2 – Unconfident 3 – Neutral 4 – Confident 5 – Very Confident	446	3 (2–4)	4 (3–5)	**<0.0001**
9	How comfortable are you using a tourniquet to stop a severe bleed?	1 – Very Uncomfortable 2 – Uncomfortable 3 – Neutral 4 – Comfortable 5 – Very Comfortable	444	3 (2–4)	4 (3–5)	**<0.0001**
10	If someone was severely bleeding, how likely would it be that you would try to assist them?	1 – Very Unlikely 2 – Unlikely 3 – Neutral 4 – Likely 5 – Very Likely	444	4 (3–5)	4 (4–5)	**0.0096**
11	If you were by yourself and someone was severely bleeding, how likely would it be that you would be able to help them?	1 – Very Unlikely 2 – Unlikely 3 – Neutral 4 – Likely 5 – Very Likely	445	4 (3–5)	4 (3–5)	**<0.0001**
12	If someone was severely bleeding and a tourniquet was available, how likely would you be to use a tourniquet to help the person?	1 – Very Unlikely 2 – Unlikely 3 – Neutral 4 – Likely 5 – Very Likely	445	3 (3–4)	4 (4–5)	**<0.0001**

Proportion of students with concerns that may prevent them from helping a bleeding person				
Survey Question Text	Answer Choices	Proportion of Pre-training Responses (%)	Proportion of Post-training Responses (%)	*P*-value
Select all that apply: Would any of the following make you less likely to try to help a person who is severely bleeding?	Fear of making a mistake	66.2	61.7	0.07
	Do not want to hurt someone	49.4	43.9	**0.03**
	Do not feel like I know how	32.4	14.8	**<0.0001**
	Feel like there are better people to help	28.0	29.1	0.62
	Do not like blood	12.1	13.7	0.31
	Other	1.8	0.9	---

*Diagrams used in these questions can be found in the Online Data Supplement.

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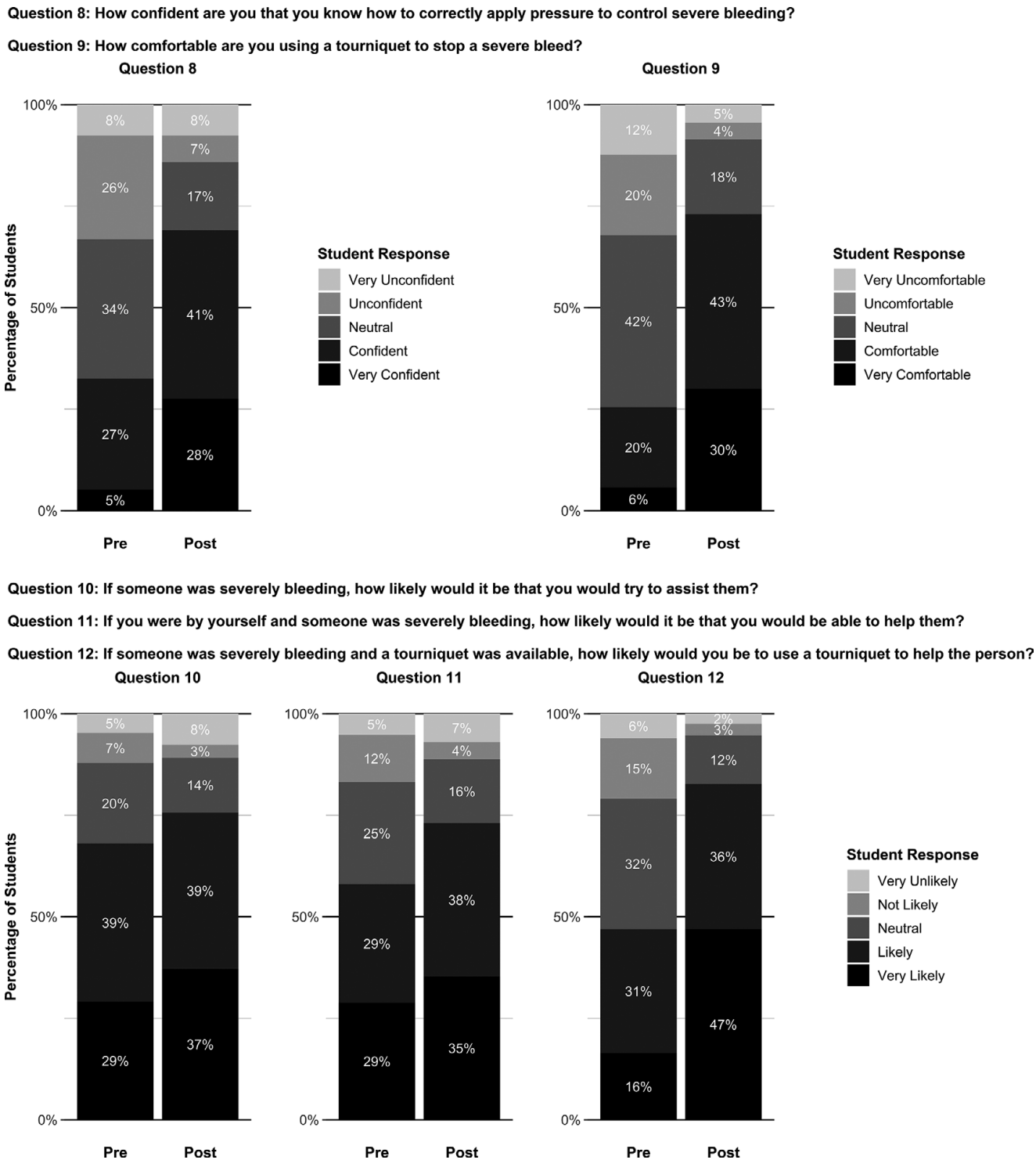

Figure 1. Proportion of students that selected each Likert scale response on their pre- and post-training surveys.

demonstrated a post-training success rate of 97% for direct pressure, wound packing, and tourniquet placement, a significantly increased likelihood to take action (71% vs. 96%; $P < 0.001$), and improved confidence applying pressure (66% vs. 95%; $P < 0.001$) and tourniquets (35% vs. 97%; $P < 0.001$). However, these investigators did not utilize the STB curriculum; instead, they developed a 5-step teaching method derived from the ACS Advanced Trauma Life Support® (ATLS) course. Moreover, their trainings were led by physicians, not health care students. Nevertheless, these results corroborate the present study's findings that middle school students can comprehend and perform basic bleeding control skills and that bleeding control training can increase the students' confidence to act.

Other studies assessing bleeding control training in adolescents have typically been conducted in high school students, utilizing various training modalities and measures of efficacy. In general,

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results for high school students tend to follow similar trends, with significant increases in self-efficacy, skill application, and willingness to provide aid.[5–7]

The present study indicates that interprofessional groups of health care students are effective STB instructors. Previous research helps corroborate these findings. Schroll et al. demonstrated that medical students can serve as competent STB instructors despite not possessing the official credentials suggested by the ACS,[11] while Moton and colleagues demonstrated the efficacy of a STB training initiative in which pharmacists provided the lecture and interprofessional health care students led the hands-on skills training portion.[10] However, both studies assessed adult training programs. The present study provides new insight into the scope of health care student-led initiatives by demonstrating that health care students can serve as lead STB instructors and interprofessional groups of health care students can effectively train middle school students in bleeding control measures.

These findings are important for several reasons. Effective bleeding control measures must be initiated as soon as possible, and the more laypeople trained and willing to provide such measures, the more likely it is that rapid assistance will be provided. These results emphasize that health care students can effectively increase STB instructor pools, making more community trainings feasible, and that middle school students can develop the knowledge and confidence necessary to expand the number of community responders. This practice aligns with emerging trends in trauma education, placing a greater emphasis on first aid, basic life support, and trauma care training among adolescents, primarily influenced by the alarming escalation in violence and trauma within school environments. Forty states have now implemented mandatory basic life support training for school-aged children, reflecting the urgency to equip this demographic with life-saving skills.[12] Several states have enforced mandates to provide STB training in public schools, though few have specifically required this training be delivered to students.[13] The present study indicates that an increased emphasis on student STB training may represent a valuable public health initiative.

This study provides an example for how health care students and faculty can help address the knowledge gap surrounding bleeding control skills in the general population. With mentorship from a limited number of clinical faculty members, 103 health care and 805 middle school students were trained in bleeding control techniques with plans to expand this training program to additional schools in the coming years. Further emphasizing the potential impact of this training, the schools included in this project were located in areas that typically experience greater health disparities and less access to care.[14–15] Additionally, 141 bleeding control kits were donated to local schools, equipping nearly every classroom with lifesaving materials, thanks to funding from student-led grants. Furthermore, this project provided meaningful community service and interprofessional learning experiences for health care students, including unique opportunities to obtain grant funding and deliver community education for low health-literacy audiences.

Limitations

Results from survey-based studies are subject to inherent biases, including recall bias, response bias, or social-desirability bias. Additionally, self-reported measures rely on subjective perceptions, which may not always align with objective performance, especially if the individual has lower literacy. Further, post-training surveys conducted immediately after the training cannot assess long-term knowledge retention. Though not feasible in the present study given volunteer and time limitations, future studies incorporating objective skill assessments may provide a more accurate evaluation. Despite efforts to maximize survey completion rates, 44.5% of students did not complete both surveys and were excluded from the analysis, reducing statistical power and external validity, and increasing the risk of non-response bias and selection bias.

Conclusions

While STB training has proven effective in various adult populations, this study is among the first to provide evidence that interprofessional, health care student-led STB training can significantly increase bleeding control knowledge and self-efficacy among middle school students.

Supplementary material. The supplementary material for this article can be found at http://doi.org/10.1017/dmp.2025.78.

Author contribution. Lorenzo Canseco – Project co-leadership, obtained grant funding, assisted with planning, development, and implementation of Stop the Bleed courses in the community, data gathering, data analysis, literature review and background research, and manuscript writing; Abigail Johnson – Project co-leadership, obtained grant funding, assisted with planning, development, and implementation of Stop the Bleed courses in the community, data gathering, data analysis, literature review and background research, and manuscript writing; Jonathan Mathews – Project co-leadership. Assisted with planning, development, and implementation of Stop the Bleed courses in the community, data gathering, data analysis, literature review and background research, and manuscript writing; Travis Carlson – Acquisition, analysis, and interpretation of data for the work; reviewing the work critically for important intellectual content; final approval of the version to be published; agreement to be accountable for all aspects of the work; Shelby Humpert – Implementation of Stop the Bleed courses in the community, data analysis and statistics, manuscript revising; Kajal Bhakta – Project co-leadership, obtained grant funding, assisted with planning, development and implementation of Stop the Bleed courses in the community, data gathering, data analysis, literature review and background research, and manuscript revising; Sorina B. Torrez - Implementation of Stop the Bleed courses in the community, data analysis and statistics, manuscript revising; Kirk E. Evoy – Project co-leadership, obtained grant funding, assisted with planning, development, and implementation of Stop the Bleed courses in the community, data gathering, data analysis, literature review and background research, and manuscript writing.

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Competing interests. The authors report no conflicts of interest, financial or otherwise.

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