which had the lowest RSV, respectively. North Dakota had the lowest OD rate (6.0-fold less than WV), and its residents searched for related terms 3.2-fold less than WV. There was a strong positive association between the 13-year RSV average of search terms and the crude rate of OD by state ($r_s = 0.73$; 95% CI, 0.57–0.84; Fig. 2).

U.S. search engine queries for MAT increased substantially over the last 14 years, and were associated with increasing prevalence of OD nationally and as it varies by state. Using the report by Andrilla et al. that described the geographic distribution of providers with a Drug Enforcement Administration waiver for prescribing buprenorphine to treat OUD, many of the states with an increased rate of OD and low RSV frequency (Fig. 1) were in States with a dearth of waivered providers [14].

This study was limited by its inability to isolate searches from persons with OUD, which limits our ability to make strong inferences about individual behavior [15]. Despite this, the strong association between Internet searches and OD over 14 years of data suggests those primarily or peripherally afflicted by the opioid epidemic may be a driver for RSV frequency.

Given this increasing interest in MAT over time and recent findings of the low prevalence of facilities in the U.S. that offer MAT [16], expansion of ED-based MAT programs is justified.

Sources of support

None.

Declarations of interest

The authors declare no conflicts of interest.

Author contributions

JN, AZ, RP, AR conceived the study. JN, AZ were responsible for data collection. JN, AZ, RP, AR provided statistical advice on study design, and JN, AZ analyzed the data. JN drafted the manuscript, and all authors contributed substantially to its revision. JN takes responsibility for the paper as a whole.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ajem.2019.04.021.

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Stop the bleed training outreach initiatives targeting high school students: It takes a community to save a life

Over the last several years, there has been an increase in mass shootings in the United States [1-3]. Although emergency response times are often <15 min in major cities, there is valuable time that is not always utilized, while the victims wait for emergency

Table 1
Pre- and post-course differences[a].

Course assessment questions	Pre-course N = 230		Post-course N = 230		% Difference	p-Value
Are tourniquets safe?	Yes	171 (74.4%)	Yes	227 (98.7%)	21.0%	<0.0001
	No	49	No	3	(95% CI: 15.3% to 26.7%)	
	NR	10				
Are you willing to apply a tourniquet in an emergency?	Yes	196 (85.2%)	Yes	228 (99.1%)	12.4%	<0.0001
	No	30	No	2	(95% CI: 7.8% to 17.0%)	
	NR	4				
Are you comfortable using a tourniquet in an emergency?	Yes	154 (67.0%)	Yes	219 (95.2%)	26.1%	<0.0001
	No	69	No	11	(95% CI: 19.5% to 32.8%)	
	NR	7				

Pre- and Post-Course Differences shows the participant responses to questions on tourniquet safety, willingness, and comfort in using a tourniquet both before and after the Stop the Bleed course. The percent differences are given with a 95% confidence interval (CI) and a p-value. Underline values significance defined as p<0.05.
[a] NR = No response.

responders. In the hopes of increasing survival in the event of a mass casualty incident, the American College of Surgeons (ACS) launched the Stop the Bleed (STB) national awareness campaign on hemorrhage control in 2013 [4]. STB provides training to civilians in stopping uncontrolled bleeding in emergency situations. Since its initiation, the campaign has gained over 15,000 instructors who have trained over 120,000 individuals throughout the nation [5].

General first aid training has been shown to increase confidence in bystander intervention during an emergency and consequently increase the quality of help given [6]. A couple prior studies have found an increase in confidence and knowledge in hemorrhage control and application of tourniquets after a STB training course [7,8], but these studies have included participants with some particular experience or interest in medicine. High school students are a particularly vulnerable population with regards to mass casualty incidents, and they generally have no prior medical experience. In 2018 alone there were 82 school shooting incidents and 51 victims killed within the U.S., which is the most since 1970 [9]. High school students are at higher risk of being present during mass shootings and thus more likely to be at the scene of a mass shooting before medical professionals and first responders arrive. Thus, we aimed to determine if high school participants' knowledge base, confidence, and willingness to help victims with bleeding differ, before and after a Stop the Bleed training course.

We initiated a STB education campaign in our catchment area in South Florida. STB courses were offered to high school students and were conducted by Stop the Bleed ACS certified and registered instructors. A 10-question pre-course survey and 9-question post-course survey was developed to assess participants knowledge base, confidence, and willingness to help victims with bleeding.

Surveys were completed on a voluntary basis, with no compensation for participation. Responding to the survey implied consent. This study was approved for exempt status by our Institutional Review Board. Participants with prior hemorrhage control training or military service were excluded. All identifiable personal information was removed. Statistical analyses was conducted with Chi Square and significance was defined as p-value < 0.05.

There were 230 subjects involved in the training, and were included for analysis. Participants were 58.3% female, 96.5% under 18-years-old, and 76.5% Caucasian. Before and after survey response rates were 100%. All subjects were high school students, none of whom had prior STB training. After training, responses to whether tourniquets are safe significantly increased from 74.4% to 98.7% ($p < 0.0001$), responses to willingness to apply tourniquets significantly increased from 85.2% to 99.1% ($p < 0.0001$), and responses to comfort to apply tourniquets significantly increased from 67.0% to 95.2% ($p < 0.0001$). Full results are demonstrated in Table 1.

South Florida resident are still reeling from the Parkland shooting at Marjory Stoneman Douglas High School in 2018 — the deadliest school shooting in U.S. history. While searching for a means to prevent futures tragedies like this, we do have the ability to improve our medical response in the case of another mass casualty incident. Providing STB training to high school students may empower students to act in a mass casualty.

Our study is the first to specifically assess the effectiveness of a STB training course in high school students. It is encouraging that we found significant improvements in the students' knowledge of, willingness, and comfort to use a tourniquet, and we believe that the widespread use of STB training to high school students could save lives. Our study validates that STB training is successful in increasing both participant comfort and knowledge of effective hemorrhage control techniques.

That being said, a prior study found that one-month after a STB training course only 16.4% of participants had purchased a tourniquet when 74.7% claimed they would [10]. Without access to a tourniquet, the skills learned in a STB course will have little effect. Thus, the placement of bleeding control kits in hospitals, schools, and high traffic areas throughout the nation should be considered. Empowering individuals by giving them the knowledge and tools to act in a time of need may prove lifesaving in mass casualty events [11]. Previous hemorrhage control studies have also highlighted common mistakes observed in tourniquet application, with inadequate tightness being the most common [12]. This calls for a need to emphasize the importance of tightness in tourniquet application.

Stop the Bleed training programs can significantly improve high school students' knowledge of and willingness/comfort to use a tourniquet in an emergency. This can be lifesaving in the event of a mass shooting or casualty situation.

Conflicts of interest

None.

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Reduction in unnecessary CT scans for head-injury in the emergency department using an FDA cleared device

Emergency Department (ED) visits for mild Traumatic Head Injury (mTBI) have greatly increased due to more awareness of potential consequences of such injuries [1]. While the vast majority (>80%) of mTBI patients who go to the ED receive a head CT scan, >90% of them are found to be negative [2]. This practice unnecessarily exposes these patients to radiation, increases the use of ED resources, and lengthens throughput times [3]. The integration of reliable, objective predictors of intracranial injury for making important initial assessment decisions [4] can impact significantly on this practice.

Hanley and colleagues (2017) [5] described the results from a multisite independent prospective FDA validation study using the EEG based biomarker output of the BrainScope One Structural Injury Classifier (SIC). Sensitivity was reported to be 99% for detecting hematoma's with ≥1 cc, in head injured patients with GCS 13–15, evaluated within 72 h of injury (see Hanley et al., for details and full performance metrics).

The current observational study investigates the clinical utility in the ED of integrating the EEG based SIC biomarker in initial assessment of mTBI patients, providing information to aid in the reduction of unnecessary CT scan referrals compared with standard site clinical determinations. A convenience sample of ninety-one (91) patients were evaluated between 6/2017–8/2018 at Barnes-Jewish Hospital Washington University Medical Center ED. Patients were 18–76 years of age (mean 44.64, sd = 17.6), 57% male, presenting to the ED within 3 days of sustaining a closed head injury (mean time since injury 10.8 h, range 1–62, with sd = 12), and all but one had a Glasgow Coma Scale (GCS) score of 15 (one patient GCS = 14). Eighty-two percent (82%) of the injuries were caused either by motor vehicle collisions (MVCs) or falls.

All patients received a CT scan which was read by the site neuroradiologist and evaluated for related traumatic injury. Patients also received an EEG evaluation (5–10 min acquired using the BrainScope One handheld device), with a disposable headset which places electrodes on the frontal and frontotemporal forehead regions [6].Physician assistants, nurses and technicians administered the EEG evaluation.

Two potential initial evaluation pathways were compared for CT referrals:

a. *Clinical Site Practice Referral:* Relying on clinical judgement of the ED physician according to site standard of care.
b. *EEG Based Classification Algorithm Assessment*: Relying on the ternary output of the SIC (positive, negative, equivocal) to inform CT referral decision. The SIC is an electrophysiological based biomarker derived from selected EEG features and a small set of clinical associated symptoms, using machine learning and advanced classification algorithms to identify those features which optimally characterize the pattern of changes in brain function that occur with head injury. Of the 91 patients referred to CT, 13 were read as positive and 78 as negative. These 91 CT referrals made using the clinical judgement decision pathway resulted in 78 patients who were found to be CT negative. Using the second pathway with input from the EEG based classification algorithm assessment (SIC) resulted 63 of the patients to be positive for CT referral. Thus, the use of the *EEG Based Algorithm* decision pathway to aid in referral for CT scanning would have resulted in 63 patients being referred for CT scans instead of 91 referrals made following standard clinical site practice. This represents a reduction of 28 fewer head CTscans, a 30.8% (= (91–63)/91) reduction.

While still early in the clinical use of this EEG based biomarker, this data demonstrates that the BrainScope One medical device can provide objective information to aid in the initial assessment of mTBI patients in the ED. Integrating this data into the decision-making process for CT referrals would have lead to a significant reduction of ~31% in CT scanning. Importantly, this decrease in