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# Stop the Bleeding Educating the Public

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## JAMA SURGERY

### Effectiveness of Instructional Interventions for Hemorrhage Control Readiness for Laypersons in the Public Access and Tourniquet Training Study (PATTs): A Randomized Clinical Trial

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**QUESTION** How effective are point-of-care audio instructions, visual instructions, and in-person training at enabling laypeople to control hemorrhage using a tourniquet, and will they retain this skill?

**FINDINGS** In this randomized clinical trial, 465 participants were randomized to 4 arms to evaluate tourniquet application, and 303 (65%) were assessed for retention 3 to 9 months after completing their training. Bleeding control training (88% correct application) was superior to control (16%) while flashcards (20%) and audio kits (23%) were not, and 3 to 9 months after training, 165 (55%) correctly applied a tourniquet.

**MEANING** In-person training is currently the most efficacious means of enabling bystanders to control hemorrhage; however, investigating refresher training or improved point-of-care instructions is critical.

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**Uncontrolled hemorrhage** is the single most preventable cause of death following traumatic injury. Bystanders can control bleeding and potentially save lives if they are willing to intervene. Bystander engagement has been identified as a vital first link in the chain of survival following injury.<sup>1</sup>

Efforts to promote greater awareness about bleeding control techniques in the civilian environment evolved through lessons learned from the military. The conflicts in Iraq and Afghanistan have led to significant improvements in the identification and out-of-hospital treatment of massive hemorrhage.

Before the conflicts, the US military's approach to out-of-hospital hemorrhage discouraged the use of tourniquets because of fear for limb loss from ischemic injury. More recent experience with battlefield trauma



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showed that the opposite was true and that the survival benefits with tourniquets far outweighed the risks.<sup>2</sup> In 1996, medical treatment guidelines for special operations forces were published that later evolved into the Tactical Combat Casualty Care (TCCC) curriculum.

The TCCC curriculum focused on the most common causes of preventable combat death and emphasized tourniquet use in the control of extremity bleeding. Despite the TCCC guidelines, protocols promoting the widespread use of tourniquets at the start of the conflicts in Iraq and Afghanistan had not yet been developed. Death from extremity hemorrhage during this period accounted for 7.8% of all battlefield fatalities.

With the increased availability of tourniquets and the implementation of TCCC guidelines, tourniquet use became more widespread in the US military and mortality decreased significantly. Between 2006 and 2011, mortality from extremity hemorrhage was reduced to 2.6% of all battlefield fatalities.<sup>3</sup> The use of commercially developed tourniquets and improved training of all, including nonmedical, combat personnel was credited with this decrease in combat mortality.

Improvements in the design of commercially available tourniquets substantially changed the approach to massive extremity hemorrhage in the out-of-hospital environment. These tourniquets were durable, functioned in austere environments, could be applied quickly, and were designed with a windlass mechanism that, upon twisting, affords a mechanical advantage resulting in better hemorrhage control.

Improvised tourniquets<sup>4</sup> can be used; however, these type of tourniquets were found to be unreliable when used in stressful, combat environments with failure rates exceeding 30%.<sup>5</sup> The failure of the improvised tourniquets might have been caused by a lack of appropriate materials on hand and the higher levels of pressure needed for narrow tourniquets to stop arterial bleeding.

Commercial tourniquets are wide and these type of tourniquets require less pressure to effectively control bleeding. Furthermore, the application of other basic bleeding control techniques such as direct pressure or wound packing will effectively control extremity bleeding in most cases if a tourniquet is not readily available. Although the quality of evidence supporting various techniques for out-of-hospital management of hemorrhage was low in general, an expert panel<sup>6</sup> concluded that direct pressure, wound

packing, and tourniquet application are easily taught critical skills that can improve survival if implemented quickly after injury.

To assess the best way to teach hemorrhage control skills to non-medical personnel, Goralnick et al<sup>7</sup> conducted a study published in the May 9, 2018, online issue of *JAMA Surgery* examining the effectiveness of various training modalities for how to use tourniquets to manage hemorrhage following a civilian mass casualty event. Employees (n = 465) at a National Football League stadium were randomized into 3 groups and taught to apply tourniquets using different learning methods: one group had access to audio and visual instructions, another had visual flashcards only, and the third was formally trained using a course created by the American College of Surgeons. A fourth group was presented with a kit and no training and served as a control.

The group undergoing formal training more effectively applied the tourniquet immediately following the training compared with the control group (88% considered the correct application vs 16%, respectively;  $P < .001$ ). The groups receiving training via the flashcards (20% considered the correct application) and the audio programs (23% considered the correct application) were not effective at improving proper tourniquet application.

Retention of tourniquet application skills was tested between 3 to 6 months after the initial training and 55% of the formally trained individuals could still correctly apply a tourniquet. These findings

affirm the importance of in-person, hands-on training rather than reliance on written instructions or the use of video modules in the teaching of bleeding control skills to nonmedical responders.

But will civilians do this? A recent telephone survey undertaken to assess the public's willingness to assist a person who is bleeding suggested they will. More than 90% of respondents indicated that they would likely help a stranger who was bleeding. In addition, 82% of those surveyed who were physically able to provide aid indicated that they would be interested in attending a class that taught bleeding control techniques.<sup>8</sup>

The national initiative was developed to inform, educate, and train bystanders to serve as immediate responders in situations in which early control of active hemorrhage could prevent death. To support this goal, efforts are under way to position bleeding control kits where members of the public would have immediate access to this lifesaving equipment in the way that automated external defibrillators are currently deployed.

The lessons learned over a decade of military conflict are helping to guide the civilian response to situations in which uncontrolled hemorrhage is encountered. Basic bleeding control skills are within reach of nonmedically trained individuals and the coordinated dissemination of this information to the general public could possibly help to reduce the risk of preventable death due to hemorrhage.

#### ARTICLE INFORMATION

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