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Use of mobile learning module improves skills in chest tube insertion☆

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ABSTRACT

Background: Just-In-Time Learning is a concept increasingly applied to medical education, and its efficacy must be evaluated.

Materials and methods: A 3-minute video on chest tube insertion was produced. Consenting participants were assigned to either the video group, which viewed the video on an Apple® iPod Touch immediately before chest tube insertion, or the control group, which received no instruction. Every participant filled out a questionnaire regarding prior chest tube experience. A trained clinician observed participants insert a chest tube on the TraumaMan® task simulator, and assessed performance using a 14-item skills checklist.

Results: Overall, 128 healthcare trainees participated, with 50% in the video group. Participants included residents (34.4%, $n = 44$), medical students (32.8%, $n = 42$), and U.S. Army Forward Surgical Team members (32.8%, $n = 42$). Sixty-nine percent of all participants responded that they had never placed a chest tube, but 7% had placed more than 20. Only 25% of the participants had previously used TraumaMan®. Subjects who viewed the video scored better on the skills checklist than the control group (11.09 ± 3.09 *versus* 7.17 ± 3.56, $P < 0.001$, Cohen's $D = 1.16$). Medical students (9.33 ± 2.65 *versus* 4.52 ± 3.64, $P < 0.001$), Forward Surgical Team members (10.07 ± 2.52 *versus* 8.57 ± 3.22, $P < 0.001$), anesthesia residents (8.25 ± 2.56 *versus* 5.9 ± 2.23, $P = 0.017$), and subjects who had placed fewer than 10 chest tubes (9.7 ± 3 *versus* 6.6 ± 3.9, $P < 0.001$) performed significantly better with the video.

Conclusions: The procedural animation video is an effective medium for teaching procedural skills. Embedding the video on a mobile device, and allowing trainees to access it immediately before chest tube insertion, may enhance and standardize surgical education for civilians and military personnel.

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1. Introduction

The past decade has witnessed a dramatic reduction in resident work hours [1]. Although the effect of this decrease on surgical resident caseload is debatable [2], it is clear that today's trainees have significantly less in-hospital time to learn the clinical skills essential to standard general surgical practice [3].

The response to this knowledge and training deficit is still evolving, but improved surgical education plays a central role [4]. Current educational theory places a premium on multimodal education: combining visual, auditory, and tactile elements to engage all learning styles while maximizing knowledge retention [5]. Novel means of surgical education—online curricula, virtual reality trainers, and high-fidelity haptic feedback simulators—ideally should embrace this multimodal approach.

Technologic advancement does more than provide sophisticated platforms for multimodal education. It enables that education to occur at almost any time and in any location. Just-In-Time Learning (JITL) refers to brief educational experiences targeted to a specific need or clinical question [6]. These experiences are available to residents undertaking a procedure for their first time, or to seasoned clinicians reviewing long-held practices. A JITL experience immediately prior to undertaking a minor surgical procedure may serve to review that procedure, reinforce existing knowledge, and remind the clinician of key procedural steps.

This study evaluates a 3-minute mobile learning module detailing the knowledge and skills necessary for proper chest tube placement. The module is contained on a mobile device (such as a smartphone), but is also easily accessed and downloaded through an online portal. Whereas textbooks or training simulators are unwieldy and require longer blocks of dedicated time, the mobile learning module provides a potentially beneficial JITL experience prior to chest tube placement. Our hypothesis is that subjects who use the mobile learning module will benefit from the JITL intervention, demonstrating improved chest tube insertion performance when compared to controls.

2. Materials and methods

A mobile learning module on chest tube insertion was written and produced as part of our Trauma and Critical Care Mobile Learning Curriculum. In this curriculum, the trauma fellows and faculty create the module content, including a script and associated representative images. A production company synthesizes these components into a multimedia presentation including professional voice, soundtrack, live animation, and video. Fig. 1 is a screenshot of the chest tube module. Subsequently, a 14-item skills checklist, modeled after key steps in chest tube insertion highlighted in the video, was developed by the Director of Clinical Education and pilot tested with the surgical residents.

Subjects in this study were drawn from three cohorts. Medical students were required to have completed a minimum of two years of training and be enrolled in an ACGME-certified allopathic medical school. The second cohort was composed of both surgical and nonsurgical residents and fellows currently enrolled in a United States training program. Lastly, the United States Army Forward Surgical Team (FST) members rotating through the University of Miami/Ryder Trauma Center at the Army Trauma Training Center (ATTC) were enrolled in the study. FSTs consist of discrete 10- to 20-person units who train at the ATTC prior to their deployment [7]. At minimum, FSTs consist of a general surgeon, nurses, and paramedics, all of whom are considered capable of placing a chest tube in the field.

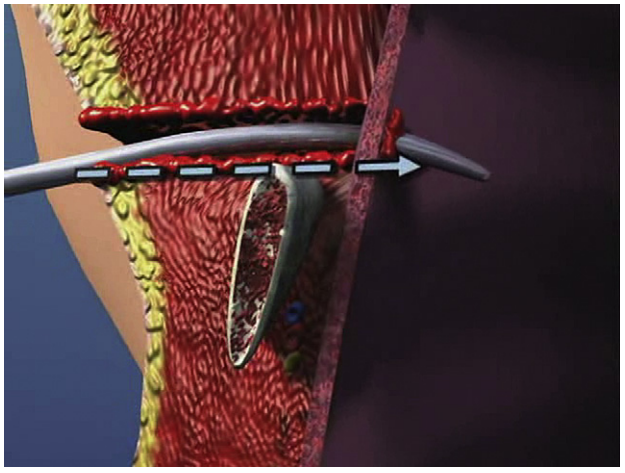

Fig. 1 – Screen shot of the chest tube mobile learning module.

Recruitment took place from July through December 2011. Consenting subjects were assigned to either the intervention group, which viewed the mobile learning module on an Apple iPod Touch®, or the control group, which did not view the mobile learning module or receive any other instruction. Those in the intervention group were monitored to ascertain that they watched the module and did not share it with controls or other bystanders. All subjects filled out an adjunct, standardized questionnaire regarding prior experience placing and learning about chest tubes. They received explicit instruction not to share information regarding the procedure or study with their peers.

Subsequently, subjects were presented with a standardized patient scenario and asked to place a chest tube on the TraumaMan® task simulator (SIMULAB Corporation, Seattle, WA). Two surgical residents with training in the correct placement of chest tubes observed the participants insert a chest tube, using the skills checklist to assess performance. The evaluators used the content of the modules to determine what constituted accepted thresholds for adequate technique. Descriptive statistics were calculated using SPSS 19.0 (IBM, Chicago, IL), and each group was analyzed using a Student *t*-test with significance level set to $P \leq 0.05$. Cohen's D statistic was calculated to determine effect size. Cohen originally introduced the statistic to measure of the strength of the relationship between two variables in a statistical population [8]. A Cohen's D value of 0.2 is considered a small effect, 0.5 a medium effect, and 0.8 a large effect. The research was exempt approved by the Institutional Review Boards at both the University and the United States Department of Defense.