Web-Based Media for Landing Zone Safety Instruction

Marc A. Bellazzini, MD, Michael D. Repplinger, MD, and Ronald E. Gangnon, PhD

Introduction

Helicopter emergency medical service (HEMS) missions provide vital transport of critically ill patients. Heightened awareness of HEMS safety has resulted from an escalating number of crashes, increasing from 1.7 per 100,000 flight hours in 1996 to 1997 to 4.8 per 100,000 flight hours in 2003 to 2004.[1] One estimate puts crewmember risk of fatal crash over a 20-year career at 37%.[2]

The need for safety instruction can be categorized into crew safety and ground personnel safety training. Industry standards dictate that, at minimum, crewmembers must complete safety training yearly.[3] This training includes identifying appropriate landing zones and communication with ground emergency medical services (EMS) personnel.[4] However, participation in an 8-hour refresher course has not demonstrated long-term knowledge retention.[5] An alternate method of instruction using streaming online media proved superior in this regard.[6]

No particular regulations exist with respect to ground personnel training, though this is a crucial aspect for a successful mission.[7] Knowledge of landing zone safety can assist in preventing delays in transport and reduce unnecessary exposure to the inherent dangers of HEMS.[8] Few studies have investigated the frequency or means of landing zone safety instruction to EMS and firefighters. Organizing a community outreach lecture series at various locations in an air medical transport service area is complicated, and capturing all fire and EMS personnel at one time is nearly impossible.

Using streaming media as a teaching medium has been successful in medical education over the past decade. Both live and prerecorded presentations have been shown to be easily accessible using a computer with internet connectivity.[9] Compressed audio and video allow for a virtual classroom that is readily available at the viewer's convenience and allows for cost containment.[10] A natural extension of this phenomenon is the use of podcasted lectures, a method that circumvents problems in the audio/video quality of streaming media by downloading the lecture file.[11]

An informal survey of our flight service area indicated that many firefighters and EMS personnel had not received landing zone safety training in the preceding 2 to 3 years despite frequent on-site training events offered by our program. This gap in education led to the development of our research study. The goals of our study were to: assess baseline landing zone safety knowledge of surrounding firefighters and EMS personnel, provide helicopter landing zone safety training in an easily accessible format, and assess the educational efficacy of an on-line landing zone safety video. Our research hypothesis is that on-line landing zone training will be an effective method of increasing community EMS and firefighters' knowledge of landing zone safety.

Methods

This study involved a university-based HEMS that completes on average 1,500 missions yearly. Institutional review board approval was obtained before proceeding with the study. All ground EMS and fire departments in our immediate flight request area were invited to participate, totaling 229 departments. An estimated 10 members per department were predicted to be available for the study, totaling 2,290 participants. A written invitation was sent to all fire department chiefs and EMS administrators that outlined the purpose and registration process for the study. Follow-up phone calls by research coordinators were placed to answer any questions and encourage participation. A professionally produced landing zone safety video was created and rendered to Real Media,

University of Wisconsin School of Medicine and Public Health, Madison, WI

Address for correspondence
Michael D. Repplinger, MD, University of Wisconsin Department of Medicine, Division of Emergency Medicine, F2/201 Clinical Science Center, 600 Highland Avenue, Madison, WI 53792; mdrepplinger@gmail.com

Acknowledgments
The authors thank the Foundation for Air Medical Research and Education (FARE) for a $5,000 grant awarded for this project to cover technical costs and statistical analysis. We also thank Jason Quisling, ATP-RW/FW, and Ken Heller, RN, with Sun Prairie Fire and EMS, and Dr. Bruce Lindsay for their support.

This study is dedicated to Steve Lipperer, Mark Coyne, and Dr. Darren Bean, who lost their lives in the line of duty in May 2008.

Disclosures
This article received a $5,000 grant from the Foundation for Air Medical Research and Education.

This article was presented at the 2009 Air Medical Transport Conference and was awarded second place among oral presentations.

1067-991X/$36.00

doi:10.1016/j.amj.2010.10.010

Table 1. Safety Video Content

Purpose of video
History of program, staffing and availability
Aircraft type and capabilities
Dispatch procedures
Landing zone selection—size, markings, obstacles, winds
Aircraft landing coordination and communication
Landing procedures and scene security
Patient loading
Aircraft departure

Windows Media, and Adobe Flash format. The length of the safety video was 8 minutes and 30 seconds. An outline of the video content is found in Table 1.

Subjects were referred to our study web site, where they received information on the purpose of the study and registration instructions. The study web site was created using a Linux operating system, Apache server, PHP programming language, MySQL database and Real Media Server to stream video content. Each subject was provided a universal code to access the registration form to deter registration of nontargeted subjects. Potential participants were asked to read a consent document on the web site. Subjects consented to participation by completing registration. During registration, subjects were assigned a unique user name and password to securely access the site. They were asked to provide preliminary data including their name, the name of their department, an email address for future correspondence, their primary role (firefighter, emergency medical technician [EMT], or both), EMS level (basic, intermediate, paramedic, or none), and the time since their last landing zone training course (<6 months, 6–12 months, 1–2 years, 2–3 years, or >3 years).

After this initial information was obtained, participants took a 15-question on-line pretest, which was randomly populated from a bank of 30 questions that highlighted information found in the safety video (Table 1). The study questions were written by one of our senior pilots and were either multiple choice or true/false format. Participants were then directed to watch the on-line safety video. Subjects had the option of downloading the video or streaming the content on-line. All subjects were randomized based on their fire department or EMS agency to one of four groups: Group A was asked to take the posttest immediately after watching the video. Groups B, C, and D were asked to take the posttest 2, 4, or 6 months, respectively, after watching the video. Subjects were categorized into these groups to assess for knowledge decay over time. The posttest was automatically and randomly generated by the software from the same pool of 30 questions used for the pretest. Participants were advised of their assigned posttest date and could not access the examination before that time. As a reminder, our server was programmed to send an automated email notification to participants 1 week before their scheduled examination date. The principal investigator reviewed the test score database every week to look for noncompliance with postvideo testing. If participants did not take their posttest as instructed, they were sent another reminder. This was repeated 1 to 2 weeks later if they continued to be delinquent in posttesting. Those who did not complete the study after the third reminder were considered lost to follow-up and excluded from posttest analysis.

Mixed effects linear regression models were used to determine the impact of timing of the posttest (immediate, 2 months, 4 months, or 6 months) on change in test performance, while accounting for potential correlations within departments. Timing of the posttest was included in models as both a categorical and continuous variable. Analyses were conducted using Proc Mixed in SAS (SAS Institute, Cary, NC). A nominal *P*-value of .05 was regarded as statistically significant.

Results

A total of 257 participants were enrolled in the study. Of those enrolled, 24% were EMTs, 45% were firefighters, and 31% functioned as both EMTs and firefighters. Nineteen percent of subjects had received landing zone training within the past 6 months, whereas 31% had not received landing zone training in over 36 months.

One hundred eighty-four subjects (72%) completed the posttest (Figure 1). Ninety-four percent (72/77) of subjects assigned to the immediate posttest group A completed the posttest, whereas completion rates were lower for the other three groups (2-month group B: 55%, 27/49; 4-month group C: 64%, 32/50; 6-month group D: 53/81). Subjects who completed the posttest had higher pretest scores than subjects who did not (83.6 vs. 78.7, $P = .0028$), but this difference was not consistent across assigned groups ($P = .22$).

Pooling all four groups, a statistically significant increase was seen in posttest scores (mean change 8.3, 95% CI 5.6, 11.0, $P < .0001$). Within groups, statistically significant increases occurred in posttest scores in the immediate (mean change 11.1, 95% CI 6.0,16.1, $P < .0001$), 2-month (9.0, 95% CI 3.1, 14.9, $P = .003$), and 6-month (9.9, 95% CI 5.5, 14.5, $P < .0001$) posttest groups, but not in the 4-month posttest group (2.3, 95% CI -3.3, 8.0, $P = .41$) (Figure 2). No statistically significant differences were seen in the mean change between groups ($P = .12$ categorical, $P = .45$ trend).

Participants did not universally complete their posttests on their specified date (Figure 3). The mean number of days between the assigned and actual posttest day was: group A (0.74, 95% CI 0.09, 1.39), group B (7.08, 95% CI 2.34, 11.81), group C (9.1, 95% CI 5.47, 12.73), group D (13.30, 95% CI 6.34, 20.25), and total (7, 95% CI 4.33, 9.10).

After the study, a follow-up survey was sent to participants who completed the study. It asked them to rate on a 1-to-5 grade scale (1 = very poor/unlikely, 3 = neutral, 5 = very good/likely) the efficiency and convenience of this type of training and the likelihood that the participant would use this

Figure 1. Study populations with corresponding percentage of subjects who completed the study.

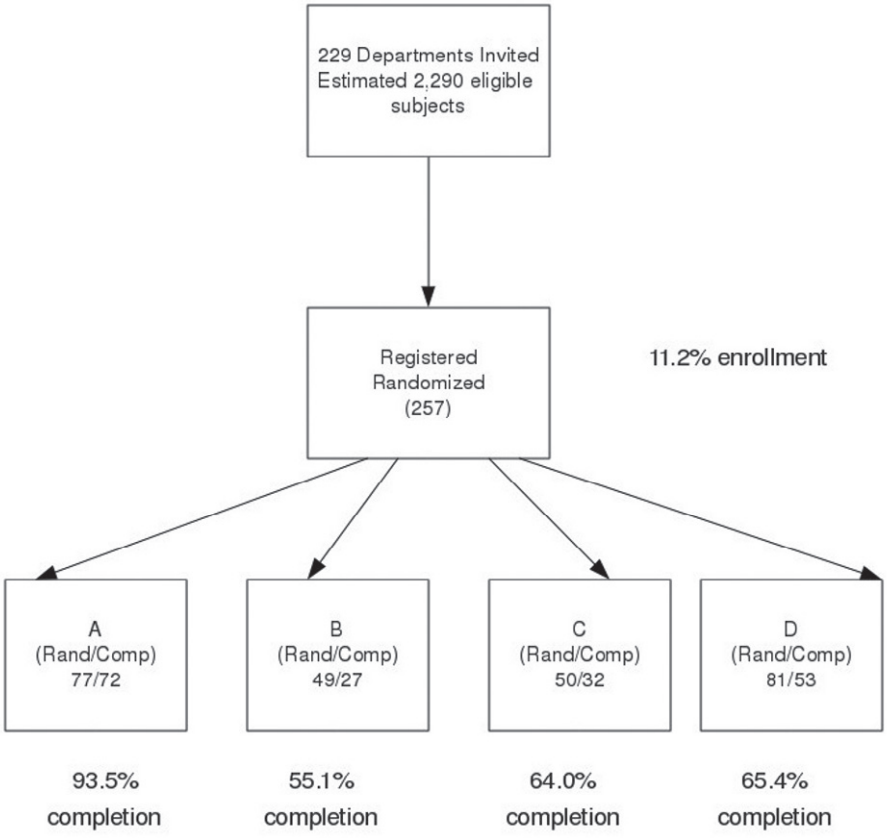


Figure 2. Mean pre-training and post-training test scores, categorized by group (A = immediate post-training, B = 2 months post-training, C = 4 months post-training, D = 6 months post-training).

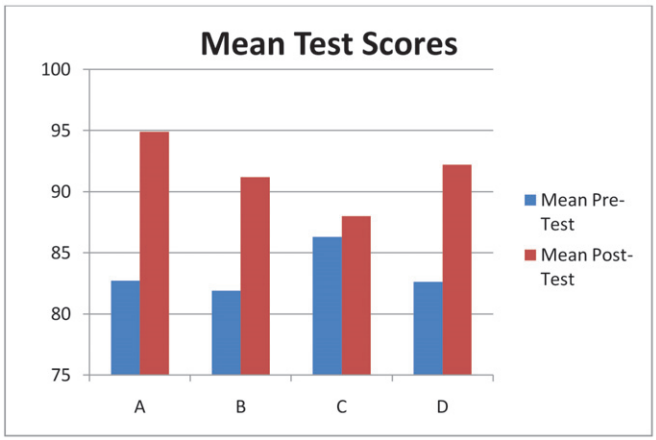
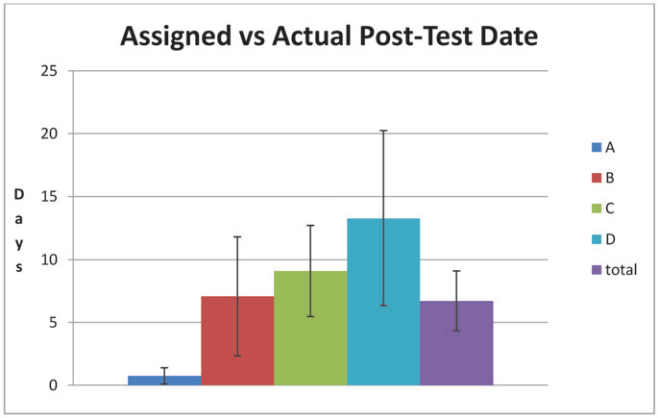


Figure 3. Actual date of post-training testing, categorized by group (A = immediate post-training, B = 2 months post-training, C = 4 months post-training, D = 6 months post-training). Superimposed ranges are the 95% confidence intervals for that group.

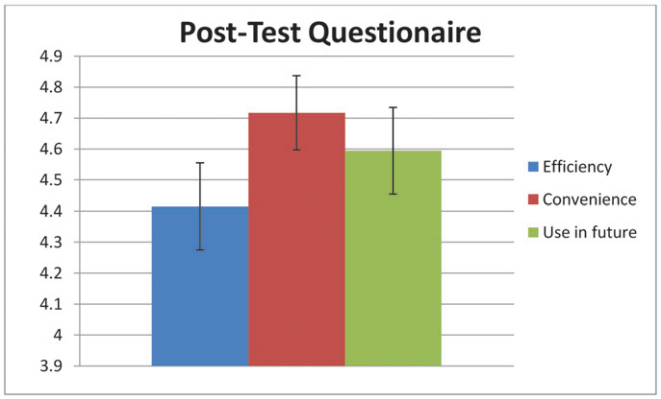


type of training in the future. One hundred six subjects (58%) answered the survey. Mean values were: efficiency (4.42, 95% CI 4.27, 4.56), convenience (4.72, 95% CI 4.60, 4.84), and likelihood of using this type of training in the future (4.59, 95% CI 4.46, 4.73) (Figure 4).

Discussion

This is the first study to investigate a method of landing zone safety instruction for ground personnel requesting HEMS transport. Using a web-based training video proved to be an effective means of teaching landing zone safety. All

Figure 4. Subject satisfaction with the online training module. Ratings are reported on a 5-point Likert scale with 1 = strongly disagree, 2 = disagree, 3 = neither agree or disagree, 4 = agree, 5 = strongly agree.



groups except group C had a statistically significant increase in posttest scores.

The study also indicated that participants had a moderate degree of baseline knowledge of landing zone safety. Given that the absolute increase in number of questions answered correctly was small, future studies should increase the number of questions on the examination. However, a balance between number of questions asked to show a relevant difference and concern for subject compliance if too many questions are listed must be borne in mind. Furthermore, even if one to two more questions were answered correctly, this could have a significant positive impact on safety. If a trainee now knows not to approach the aircraft during initial startup or shutdown, this could translate to a life saved by preventing a fatal rotor impact. Knowing how to properly identify and report hidden obstacles to an approaching aircraft could also prevent disaster.

The trend suggests statistically significant knowledge retention over a 6-month period when using this training format. Such a trend was not witnessed when studying more traditional methods of teaching, such as classroom instruction.[6] This suggests that refresher training does not need to occur more frequently than every 6 months. Further study is needed to assess for knowledge decay over longer time frames such as 1 year.

Our study also demonstrated a significant lack of landing zone safety training. More than 40% of participants had not received training in over 2 years. A web-based landing zone training video would allow for access to refresher training at any time and at any location with a computer and internet connection. Our post-study survey suggests that participants found the format both convenient and efficient and would be very likely to pursue similar training in the future if offered.[4]

There are several limitations to this study. First, there was much lower enrollment than anticipated. This low rate may be attributable to several factors, including recent training by another HEMS program in the area as well as lack of interest in participating in a study. Additionally, use of block randomization would have been better suited for individual assignments rather than by department, affording more equally sized study groups. This led to distribution irregularities between the groups. Moreover, there was no mechanism for enforcement of watching the safety video immediately after the pretest, nor was there a method to prevent reviewing the video immediately before taking the posttest. Although the study evaluated the number of participants with landing zone training within 3 years, it did not address the possibility that first responders may not have had landing zone safety training at all. Our study took place in a region well supported by HEMS and thus is biased toward similar populations. In regions of the country that are not as well served by HEMS programs, landing zone safety training may be even more deficient, and thus basic knowledge may be significantly less. Future studies should gather more information on type and quantity of landing zone safety training participants may have had. Lastly, factors affecting response rate were not evaluated.

Conclusions

Many EMS personnel and firefighters in our study group had not received landing zone training in over 2 years and had only a moderate knowledge base of the landing zone safety. This study suggests that online instruction using web-based videos is effective and convenient for teaching HEMS landing zone safety. Additionally, there was no statistically significant knowledge decay 6 months after watching the video.

References

1. Wright RM Jr. Air medical service, an industry under scrutiny. Rotor Winter 2004-2005:6-8.
2. Baker SP, Grabowski JG, Dodd RS, Shanahan DF, Lamb MW, Li GH. EMS helicopter crashes: What influences fatal outcome? Ann Emerg Med 2006;47:351-6.
3. Association of Air Medical Services. Minimum quality standards and safety guidelines: Rotorcraft/fixed-wing. Pasadena, CA: The Association; 1991.
4. Grissom CK, Thomas F, James B. Medical helicopters in wilderness search and rescue operations. Air Med J. 2006;25:18-25.
5. Wynn JS, Black S. Evaluation of retention of safety and survival training content versus industry standard for training. Air Med J 1998;17:166-8.
6. Bellazzini MA, Rankin PM, Quisling J, Gagnon R, Kohrs M. Formal testing and utilization of streaming media to improve flight crew safety knowledge. Air Med J 2008;27:84-98.
7. Taylor JE. Safety at the helicopter landing site: Preventing injuries to emergency personnel and patients. J Emerg Nurs 1985;11:325-7.
8. Thomas F, Clemmer TP. Securing the landing zone. JEMS 1985;10:52-5.
9. Tamm EP, Ernst R, Weems W. The virtual lecture: Delivery of live and recorded presentations over the internet. AJR 1999;172:9-12.
10. Tello R, Davison BD, Blickman JG. The virtual course: Delivery of live and recorded continuing medical education material over the internet. AJR 2000;174:1519-21.
11. Tripp JS, DuVall SL, Cowan DL, Kamauu AWC. Academic podcasting: quality media delivery. AMIA 2006 symposium proceedings page.