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Web-Based Media for Landing Zone Safety Instruction of First Responders

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Abstract

Introduction—Crew safety is paramount to successful helicopter emergency medical service transport. This study assesses using an online video to teach landing zone safety.

Methods—This is a randomized, prospective study using a 5-minute video to teach landing zone safety. A pre- and post-test were used to assess efficacy of the initial instruction and subsequent knowledge decay. Block randomization by EMS agency or fire department assigned participants to 0, 2, 4, or 6-month post-video testing.

Results—257 participants, including 62 EMTs, 114 firefighters, and 80 EMT/firefighters, were enrolled and randomized to immediate (A), 2-month (B), 4-month (C), and 6-month (D) post-video testing. 184 (71.6%) completed the study: A – 72 (93.5%), B – 27 (55.1%), C – 32 (64.0%), and D – 53 (65.4%). Mean scores (pre-test, post-test) were: A – (82.7%, 94.9%), B – (81.9%, 91.2%), C – (86.3%, 88%), and D – (82.6%, 92.2%). Statistically significant score increases were seen in groups A (11.1%, 95% CI 6.0%, 16.1%), B (9.0%, 95% CI 3.1%, 14.9%), and D (9.9%, 95% CI 5.3%, 14.5%). Group C had a mean increase of 2.3%, but this was not statistically significant ($p = 0.41$).

Conclusion—Web-based media is an effective means of teaching landing zone safety to first responders with minimal knowledge decay.

INTRODUCTION

Helicopter emergency medical service (HEMS) missions provide vital transport of critically ill patients. There has been heightened awareness of HEMS safety due to an escalating number of crashes, increasing from 1.7 per 100,000 flight hours in 1996–1997 to 4.8 per 100,000 flight hours in 2003–2004.¹ One estimate puts crew-member risk of fatal crash over a 20-year career at 37%.² When investigating HEMS crashes in Germany, 54% of crashes took place at the landing zone, underlining the importance of landing zone safety.³

The need for safety instruction can be categorized into crew safety and ground personnel safety training. Industry standards dictate that, at minimum, crew-members must complete safety training yearly.⁴ This training includes identifying appropriate landing zones and communication with ground EMS personnel.⁵ However, participation in an 8-hour refresher course has not demonstrated long-term knowledge retention.⁶ An alternate method of instruction utilizing streaming online media proved superior in this regard.⁷

No particular regulations exist with respect to ground personnel training, though this is a crucial aspect for a successful mission.⁸ Knowledge of landing zone safety can assist in preventing delays in transport and reduce unnecessary exposure to the inherent dangers of HEMS.⁹ There are few studies investigating 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 nearly impossible to capture all fire and EMS personnel at one time.

Using streaming media for education has been successful in medical education over the past decade. Both live and pre-recorded presentations have been shown to be easily accessible using a computer with internet connectivity.¹⁰ Compressed audio and video allow for a virtual classroom that is readily available at the viewer's convenience and allows for cost containment.¹¹ A natural extension of this phenomenon is the use of podcast lectures, a method which circumvents problems in the audio/video quality of streaming media by downloading the lecture file.¹²

An informal survey of our flight-service-area revealed that many firefighters and EMS personnel had not received landing zone safety training in the preceding 2–3 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 to 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 1500 missions yearly. Institutional review board approval was obtained prior to 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 (RM), Windows Media (WMV) 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 non-targeted 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, 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 pre-test 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 post-test immediately after watching the video. Groups B, C and D were asked to take the post-test 2, 4 or 6 months respectively after watching the video. Subjects were categorized into these groups to assess for knowledge decay over time. The post-test was automatically and randomly generated by the software from the same pool of 30 questions used for the pre-test. Participants were advised of their assigned post test date and could not access the exam prior to that time. As a reminder, our server was programmed to send an automated email notification to participants one week before their scheduled exam date. The principal investigator reviewed the test score database every week to look for non-compliance with post-video testing. If participants did not take their post-test as instructed, they were sent another reminder. This was repeated 1–2 weeks later if they continued to be delinquent in post-testing. Those who did not complete the study after the third reminder were considered lost to follow up and excluded from post-test analysis.

Mixed effects linear regression models were used to determine the impact of timing of the post test (immediate, 2 months, 4 months or 6 months) on change in test performance, while accounting for potential correlations within departments. Timing of the post test 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 0.05 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 EMT/firefighters. 19% of subjects had received landing zone training within the past 6 months, while 31% had not received landing zone training in over 36 months.

184 subjects (72%) completed the post test (Figure 1). 94% (72/77) of subjects assigned to the immediate post test group A completed the post test, while completion rates were lower for the other 3 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 post test had higher pre test scores than subject who did not (83.6 vs. 78.7, $p=0.0028$), but this difference was consistent across assigned groups ($p=0.22$).

Pooling all four groups, there was a statistically significant increase in post test scores (mean change 8.3, 95% CI 5.6, 11.0, $p<0.0001$). Within groups, there were statistically significant increases in post test scores in the immediate (mean change 11.1, 95% CI 6.0, 16.1, $p<0.0001$), 2 month (9.0, 95% CI 3.1, 14.9, $p=0.003$) and 6 month (9.9, 95% CI 5.5, 14.5, $p<0.0001$) post test groups, but not the 4 month post test group (2.3, 95% CI -3.3, 8.0, $p=0.41$) (Figure 2). There were no statistically significant differences in the mean change between groups ($p=0.12$ categorical, $p=0.45$ trend).

Participants did not universally complete their post-tests on their specified date (Figure 3). The mean number of days between the assigned and actual post-test 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 to rate on a 1–5 grade scale (1 = very poor/unlikely, 3 = neutral, 5 = very good/likely) the efficiency, convenience, and likelihood that the participant would use this type of training in the future. 106 subjects (58%) answered the survey. Mean values for 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) were all very positive (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 groups except group C had a statistically significant increase in post-test 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 exam.

However, there needs to be a balance between number of questions asked to show a relevant difference and concern for subject compliance if too many questions are listed. Furthermore, even if 1–2 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 start up or shut down 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 six month period when using this training format. Such a trend was not witnessed when studying more traditional methods of teaching like classroom instruction.⁶ This finding 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 one 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.

There are several limitations to this study. First, there was much lower enrollment than anticipated. This low rate may be due 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 pre-test, nor was there a method to prevent reviewing the video immediately before taking the post-test. 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 two 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 for teaching landing zone safety. Additionally, there was no knowledge decay six months after watching the video.

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Figure 1.

Figure 2.

Figure 3.

Figure 4.

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