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Drones at the service for training on mass casualty incident

A simulation study

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Abstract

Mass casualty incidents (MCI) are characterized by a large number of victims with respect to the resources available. In this study, we aimed to analyze the changes produced in the self-perception of students who were able to visualize aerial views of a simulation of a MCI. A simulation study, mixed method, was performed to compare the results from an ad hoc questionnaire. The 35 students from the Emergency Nursing Master from the UCAM completed a questionnaire before and after watching an MCI video with 40 victims in which they had participated. The main variable measured was the change in self-perception (CSP). The CSP occurred in 80% (28/35) of the students ($P=.001$). Students improved their individual ($P=.001$) and group ($P=.006$) scores. They also described that their personal performance had better results than the group performance ($P=.047$). The main conclusion of this study is that drones could lead to CSP and appraisal of the MCI simulation participants.

Abbreviations: A = after, B = before, CS = clinical simulations, CSP = change of self-perception, EMS = emergency medical services, GAV = group assessment variable, IAV = individual assessment variable, MCI = mass casualty incident.

Keywords: clinical simulation, mass casualty incident, training

1. Introduction

Clinical simulations (CS) have been used in health (medical) sciences training in the past, with a significant increase of its use in the past few years. CS have been shown to be useful, as they allow participants to be trained and get experience of critical situations that they may face later in their professional lives.[1]

CS can be divided into 3 phases[2]: preparation or briefing; simulation, where real medical assistance situations are recreated; and posterior analysis or debriefing, where images recorded during the scenario can be viewed. This last phase allows for reflecting on and analyzing the events that have occurred in order to evaluate the results, perceptions and self-evaluation.

Special cases of CS are the mass casualty incidents (MCI). These types of CS are characterized by having a large number of victims as compared to the resources available, and they are generally conducted outdoors. In 2012, Ingrassia et al[3] showed a greater efficiency of professional emergency medical services (EMS) workers, who were classified as trained in the management and the decision-making during a MCI.[3] CS are therefore one of the best mediums for learning about these not-so-common situations.

Until now, the videos for the debriefing phase of the MCI were created with the use of fixed cameras or cameras that were moved around within the exercise area. The current state of development of drones has brought new resources, and these new devices have already shown their usefulness in the search for victims within a MCI simulation.[4] In 2016, Escalada Roig[5] even attested that drones "could become the eyes of our medical coordination centers, which are currently blind."[5]

The hypothesis of this work is that the images and videos obtained with the use of drones are useful in training, and therefore improve the student's learning. The objective of this study was to analyze the changes produced in the self-perception and scoring of a group of students who watched aerial views of a MCI simulation after taking part in it.

2. Materials and methods

A medical simulation study uses a mixed method (QUAN-qual) in order to measure the changes produced in the debriefing phase after viewing a MCI simulation video recorded through the use of a camera system installed in drones (Fig. 1). The research project was approved by the Committee of Ethics from the Catholic University of Murcia (UCAM) and the Emergency Care

Editor: Baltasar Sánchez.

This work and these data have not been previously published anywhere.

Funding: This work was funded by the "Support for the Implementation of Teaching Innovation Projects" from the Catholic University of Murcia (UCAM), with the title "Recording of simulations through the use of drones for the improvement in debriefing," with the project number PMAFI-ID-09/15.

The authors have no conflict of interest to disclose.

Supplemental Digital Content is available for this article.

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Medicine (2017) 96:26(e7159)

Received: 5 April 2017 / Received in final form: 15 May 2017 / Accepted: 18 May 2017

http://dx.doi.org/10.1097/MD.0000000000007159

Figure 1. Picture of the drone during the recording of the mass casualty incident.

Management 061 from the Region of Murcia (GUERM-061). All participants participated voluntarily, signing a consent form. The sample comprised 35 students enrolled in the Emergency Nursing Master's Degree at the UCAM in academic year 2015 to 2016.

2.1. Study procedure

The objective of the professional workers was to: perform a search for 40 victims, perform triage (using the START system), to stabilize, and to sector the patients. Once the simulation ended, all the participants had to complete a self-administered questionnaire that was created ad hoc for this exercise. It contained open- and close-ended questions, and the participants had to rate the questions from 1 to 10. The questionnaire aimed to explore the main tendencies of the experiences lived during the simulation. Therefore, it was conducted according to the model proposed by Albert Ellis:[6] the participants were asked to describe the event (moments, behaviors, thoughts, feelings, strengths, and weaknesses), and the number of descriptions were tabulated for the further statistical analysis. The participants were also asked about their "safety pillars" divided into their "safe zone" (before the CS) and the one in which they felt "safe" (after the CS). A week after, a debriefing was conducted with the screening of the exercise's recording (Video 1, http://links.lww.com/MD/B775), after which the participants proceeded to finish completing the questionnaire.

2.2. Analysis of the results

The qualitative study of the answers was conducted by 2 instructors from the medical simulation (MPR and LJR), through the system proposed by Mayer and Quellet,[11] granting each student a number to maintain confidentiality. The main variable of the study was the change of self-perception (CSP). Also, the following variables were calculated: age, experience in emergency services, gender, individual assessment variable (IAV), group assessment variable (GAV), moments, behavior, thoughts, feelings, strengths, and weaknesses. All the variables were measured before (B) and after (A) the viewing of the video. The data analysis was conducted with the SPSS Version 21.0 program, with a basic analysis of the mean, standard deviation, percentage, sum, and mode. The normality tests were conducted with the Shapiro–Wilk test and the comparison between before and after the viewing of the video was conducted through a matched pairs Student's *t*-test for continuous variables, and the χ^2 test for nominal variables. The data were considered significant with a confidence interval of 95% ($P<.05$).

3. Results

The average age of the participants was 29 ± 5 years, with an average experience in emergency services of 15 ± 8 months, and a gender distribution of 57% women and 43% men. The main variable of our study, CSP, was found in 80% (28/35) of the students ($P=.000$). Figure 2 shows the testimonies and results of IAV and GAV, showing that the students improved their perception of their individual ($P=.001$) and group ($P=.006$) scores. Also, the students determined that their personal actions obtained better results as compared to the average group actions ($P=.047$). The qualitative analysis according to variable showed important changes in all the categories.

The moments-B obtained a total of 185 descriptions (mode=5) and the moments-A obtained a total of 259 descriptions (mode=6), with a significant increase of 40% ($P=.033$). The behavior-B obtained a total of 202 descriptions (mode=5) and the behavior-A obtained a total of 231 descriptions (mode=6), with a significant increase of 14% ($P=.031$). The thoughts-B obtained a number of 226 descriptions (mode=4) and the thoughts-A obtained a total of 250 descriptions, with a nonsignificant increase of 10% ($P=.956$). The feelings-B obtained a total of 271 descriptions (mode=4) and the feelings-A obtained a total of 287 descriptions (mode=4), with a nonsignificant increase ($P=.819$).

The strengths-B obtained a total of 75 descriptions (mode=1) and the strengths-A obtained a total of 80 descriptions (mode=1),

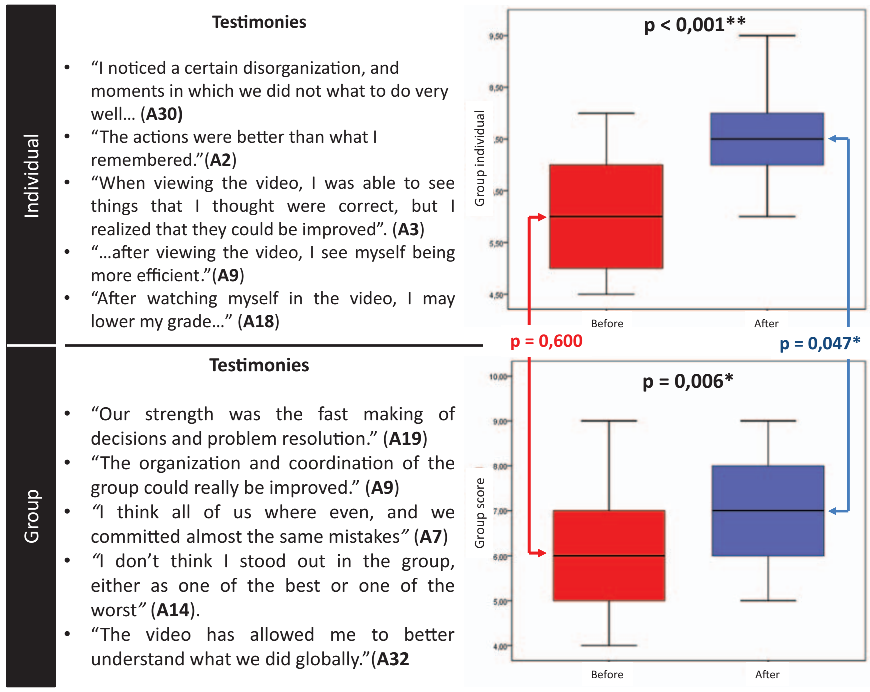

Figure 2. Testimonies and results obtained in the assessment before (red color) and after (blue color) the viewing of the video.

with a nonsignificant increase of 7% ($P = .992$). The weaknesses-B obtained a total of 49 descriptions (mode = 1) and the weaknesses-A obtained a total of 52 descriptions (mode = 1) with a nonsignificant increase of 6% in the number of weaknesses ($P = .698$).

4. Discussion

The American College of Emergency Physicians believes that at the scene of a medical emergency, the person responsible should be the individual present who is the most appropriately trained and knowledgeable in providing out-of-hospital emergency care and transport.[7] At that time, the changes in self-perception in the management of an MCI had not been registered. In this study, we were able to determine that 80% of the students modified their perception after viewing the video, granting a higher score to their own actions as compared to that of the group. At present, we do not have data or studies to compare the results obtained through the use of terrestrial videos compared to aerial videos. On the other hand, our results were similar to those obtained through the use of normal (terrestrial) videos for self-assessment in other areas of study such as in an advanced trauma support course.[8] This new use of drones for teaching has allowed the students to remember events or situations that were forgotten or ignored.

The number of behaviors and moments that the students were able to describe increased, but the rest of the variables (thoughts, feelings, strengths, and weaknesses) did not change significantly. Paradoxically, the quantitative analysis of the discourses did lead to changes in all the study variables. The cognitive, affective, and psychomotor performances were evaluated in the debriefing phase of the CS.[9] In this case, the use of a mixed methodology allowed us to measure changes in all the debriefing phases.

The use of drones allows the trainers to not only obtain aerial views, but also images of the MCI by placing cameras located strategically in the scene or cameras carried by some of the health professionals or students involved in the simulation. This option could be simpler and more economical. However, our study has shown that drones are a great resource for the training and preparing of EMS workers, in agreement with other research studies that have described their usefulness in MCI research[4] or for the emergency coordination centers.[5]

The main limitation of this study was the sample size, which was relatively low, and also, in specific sections of the video, not all the students were shown, and this could limit their ability to self-evaluate. This could be solved in future studies through the use of autonomous navigation systems and/or following the subject (*follow me* drone technology). Also, joint navigation systems or "drone swarm" systems could contribute with interesting technical solutions for these types of situations and simulations. Communication collapse is a major challenge during disasters,[10] which could be solved by using drones that transmit images of the impact zone. The main conclusion of this study is that drones can lead to changes in the self-perception and appraisal of MCI simulation participants. An improvement was produced in an individual's self-assessment, and these results were better than the group assessments. The technical benefits of the use of drones are more evident in open-air situations with a multitude of victims and large open spaces.

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