CLEVRER study: Clinical Learning Evaluation of Virtual Reality Emergency Roles

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Overview

We propose a pilot study to evaluate the feasibility, educational value and experience of virtual reality (VR) training in ward-based clinical emergencies for Post-Graduate Year 1 doctors working at Waitemata District Health Board (Waitemata DHB). While VR is emerging as a viable new technology in surgical medical education and many aspects of patient rehabilitation, its use in pre-vocational educational training is completely untested. Participants will be randomised to the intervention (VR and usual learning activities) or control (usual learning activities only) arm. In the quantitative aspect of the study, clinical knowledge, self-rated competence and self-rated confidence will be assessed at the beginning and end of the 13-week trial period. In the qualitative aspect of the study a semi-structured focus group will be conducted at the end of the study period.

1. Introduction

Increasingly education is being delivered in electronic interactive formats, augmenting the delivery of face-to-face training and creating on-demand learning opportunities. Internationally there is a groundswell of activity in clinical training that is taking advantage of technology-supported learning across virtual and social media platforms.

The current system used to train Post-Graduate Year 1 house officers in ward-based medical emergencies is delivered through didactic lectures, small group sessions and simulation. These training methods are limited due to difficulties booking rooms, securing facilitators and time constraints. In addition, training that is delivered off the wards reduces optimal staffing availability. House officers often work antisocial hours, have diverse experience and differing career aspirations. Additionally, the rotational and rostered nature of their roles creates significant challenges for standardised training delivery and attendance over the course of the year.

This study seeks to explore three main domains: *feasibility*, *educational value* and *experience.* In this study feasibility is defined as an app with four 3-D videos of clinical scenarios being successfully developed, used and maintained over the study period using resources available at our organisation. When we use the term *experience* we are referring to the learners' experience during the scenario, looking in particular at physical and emotional reactions. *Educational value* is defined as perceived or proven transfer of knowledge.

2. Aim

To conduct a pilot study evaluating the *feasibility, educational value* and *experience* of virtual reality (VR) training in ward based clinical emergencies for Post-Graduate Year 1 doctors.

3. Hypothesis

Virtual reality is an effective and feasible educational adjunct for training Post-Graduate year 1 house officers in ward-based clinical emergencies.

4. Summary of existing literature

A PubMed search was conducted on April 5th 2017 using the terms displayed in Appendix 1. This yielded 1,461 results. These were hand searched initially by title then by abstract. The vast majority of studies focussed on teaching surgical skills to specialists of all levels (medical students to consultants) or using VR for a vast array of patient rehabilitation. Two studies involved using VR in a mass casualty situation and one used VR to teach CPR. No studies focussed on junior doctors as a group. No studies looked at acute ward calls as a subject.

5. Methods

5.1 Resource development

Four VR scenarios have been developed by subject-matter experts at our organisation. These include the Director of Clinical Training, Senior Medical Officers in anaesthesia and cardiology, resuscitation educators, Medical Education Fellows at the Medical Education and Training Unit, and the Innovation Fellow at the Institute for Innovation and Improvement (i3) . The scenarios were developed by an external source with continual input from this team.

Each scenario lasts for approximately 5 minutes. Participants watch a 3-D video via a VR headset. Twice during the video participants are asked multiple choice questions. If they select the incorrect answer the scenario restarts. The subjects of the scenarios are: hypoglycaemia, cardiac arrest, anaphylaxis and atrial fibrillation.

Scenarios underwent a one month period of quality control testing prior to the intervention period.

5.2 Recruitment

There are approximately 45 PGY1 house officers at Waitemata DHB at any one time. Sample size is therefore anticipated to be approximately 20-30. Prior to enrolling in the study participants will be provided with an information sheet and investigator contact details.

5.3 Randomisation

Participants will be randomised to an intervention or control arm using an online random number generator. Participants will be given a participant number following randomisation. The database of de-identified participant details and corresponding participant numbers will be stored in an encrypted file on the DHB intranet and accessed only by investigators.

Those in the control arm will receive usual activities, a VR headset (in an attempt to minimise contamination between arms) and complete the entry and exit questionnaire detailed below. Those in the intervention arm will participate in usual learning activities, complete the questionnaires, receive a virtual reality headset and be given access to a password protected app containing the four scenarios.

Usual learning activities for the PGY1 group are:

- 60-120 minutes grade-specific weekly teaching.
- Clinical attachment specific learning activities such as grand round or departmental teaching.
- Advanced Care Life Support, an eight hour course once every two years (usually undertaken in final year medical school and PGY2).
- Ward based passive learning (house officers work in a variety of settings, their natural exposure to ward based emergencies varies by attachment).
- Self-directed learning.

The subject matter of usual learning activities during the study period will be documented and reported.

No specific time will be allocated to use the app in order to gauge perceived value of content. The intervention group will have unlimited access to the scenarios meaning they can replay the scenarios at leisure and access the materials as often as they wish, in any location.

5.4 Blinding

Study design precludes investigator blinding. However study participation will not be divulged to educators delivering usual learning activities

5.5 Data collection: Quantitative

Baseline data will be collected from participants including age, gender, current clinical attachment, graduation date and date of most recent *Advanced Life Support* training. Participants will complete surveys online using only their participant number as an identifier. This can be completed in person via ipad or subsequently via email.

Data will be collected from the app containing the VR scenarios including mean duration of use, mean length of use and average time of day the app is accessed. This will be analysed by intervention vs control group but can also be analysed by user and compared to clinical knowledge score.

The questionnaire will contain:

1. Modified Likert-type self-rated scales assessing confidence and competence in ten commonly encountered ward emergencies (five of which are the subject of VR scenarios, five are not, in order to distinguish confidence gained over the course of the run from that gained from the intervention).
2. 20 multiple choice knowledge questions – Two questions based directly on each scenario.

The questionnaire will be administered to all participants at the beginning and end of the study period.

5.6 Data collection: Qualitative

A 30-minute focus group will be conducted with a group of six participants. The focus group will be recorded, transcribed verbatim and thematically analysed. The focus group will be conducted by an experienced facilitator who is not a study investigator. Questions will be explore feasibility, educational value and experience as defined in Section 1: Introduction.

5.7 Ethical considerations

Post-graduate year 1 is a crucial time in a doctor's career. For this reason all materials have been rigorously quality controlled as described in Section 5.1. Institutional approval has been sought. The study was exempted from ethics committee approval. The participant information sheet will explain the entirely voluntary nature of the study, freedom to withdraw, that declining participation will not impact career progression, anonymity and that individual questionnaire results or in-app performance will not be shared beyond the investigators.

6. Timelines

1st May – Product completed.

1st-29th May – Proto-typing, consumer groups and alpha testing.

29th May – 27th Aug – Study period.

- Week 1: Recruitment, consent, questionnaire to all participants. Intervention group only, free access to materials.
- Week 13 onwards: Exit questionnaire, qualitative group, write up.

Feb '18 – Optional 6 month follow up

APPENDIX 1

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((train*[Title/Abstract] OR educat*[Title/Abstract] OR learn*[Title/Abstract])) AND (VR[Title/Abstract] OR virtual reality[Title/Abstract])
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Figure 1: Literature search terms