i-Trache: A pilot study to develop a novel interactive mobile device app to guide responders in a tracheostomy emergency

Hannah Donaldson¹, Antoniu Pop², Hamza Ghani², Brendan McGrath^{1,3,4}

Wythenshawe Hospital Intensive Care, Manchester University Foundation Trust, Manchester, M23 9LT, UK 2. School of Computer Science, The University of Manchester, UK 3. School of Medical Sciences, The University of Manchester, UK 4. Manchester Academic Health Sciences Centre

Introduction

Medical errors in advanced resuscitation situations have been shown to be common, and often involve human factors. During medical emergencies, multidisciplinary teams face complex tasks and time-critical decisions, predicated on memory of complex algorithms, in highly stressful environments. Smartphone-based advanced life support apps, such as the Resus Council UK's iRESUS [1], have been shown to reduce the cognitive burden of stressful situations in simulated environments, allowing clinicians to focus, thus improving their performance[1,2]. The "National Tracheostomy Safety Project" (NTSP) app[3], provides a stepwise, interactive approach to tracheostomy emergencies, with closed questions designed to guide the user through the management steps. We propose that the next logical step in assistive technology is to enable voice control and situation comprehension, which can recognise the unfolding emergency and guide the user towards the appropriate intervention. This was a proof of concept study, exploring the challenges of deploying voice recognition software in the clinical environment when managing airway emergencies.

Methods

i-Trache is developed as an open source project at the University of Manchester. It integrates the NTSP emergency airway guidelines with voice recognition technology, leveraging either standard libraries available on Android and iOS devices, or using ad hoc speech recognition software. Testing occurred in standardised simulation scenarios, using a manikin programmed to deteriorate physiologically to prompt actions from consenting participants. The i-Trache app was used by participants instead of paper algorithms and tested for usability in scenarios. We collected the frequency of failed voice commands, measured background noise and debriefed candidates using a standardised proforma.

Fig 1. Participants use mobile app to guide them through the algorithm

Ethics

Ethical approval was not required for participants who volunteered to evaluate our draft algorithms. The simulation algorithms were subject to testing rather than the participants themselves. Consent for filming and future use of images was gained.

Fig. 2 NTSP Emergency tracheostomy management algorithm

Results

We were unable to gain objective results as there were technical difficulties in using the app in a simulated environment.

Preliminary trials using standard voice libraries highlighted that the software struggled to pronounce medical terminology in the correct manner. The app was subsequently developed using voice recordings.

Ten multidisciplinary participants of varying experience completed scenarios using the i-Trache app. We identified several hurdles to future app development:

1. Voice recognition cannot be continuously active to avoid wrongly triggering app commands. A command keyword known to all participants minimizes the risk, but could reduce usability in non-simulated environments.
2. Background noise can interfere with the accuracy of the app.
3. Participants can become too focused on the app, neglecting the simulated patient.
4. Commands must be simple and only contain key points.

Key Learning Points

- Colour coding is important for recognition of correct algorithm
- Commands must be quick and concise
- Further technology will need to be developed in order to overcome ambient noise

Future Development

- Objective assessment of i-trache against paper algorithms
- Could use of large interactive touch screen devices, e.g at the bed head be more useful than mobile technology?

References

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