Perceptions and implications of cognitive aid design for medical emergencies

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Introduction: During medical emergencies a large number of tasks must be completed under stressful and time-pressured conditions. These tasks are often unrelated, complex and undertaken by several team members, requiring the team members to coordinate their activity. Omissions, unclear team roles, and poor communication have all been shown to lead to poorer patient outcomes (Lingard et al., 2004; Risser et al., 1999). Education about how to improve team function has been used to improve the outcomes of patients experiencing medical emergencies (Harrison, Manser, Howard, & Gaba, 2006; Salas, Dickinson, Converse, & Tannenbaum, 1998).

A recent systematic literature review of anaesthetic emergencies demonstrated that teams managing an emergency completed technical tasks better when they had access to additional information in the form of a ‘cognitive aid’ (Marshall, 2013). Cognitive aids are mnemonics, posters, or checklists that remind users of the prescribed tasks. Furthermore, cognitive aids also appear to improve individuals’ team working skills and the leadership, coordination and communication of the team overall (Marshall & Mehra, 2014; Marshall, Sanderson, McIntosh, & Kolawole, 2014).

Despite clear improvements in technical and team functioning when a cognitive aid is used, we do not know how to design cognitive aids so they are most effective during the management of emergencies. Cognitive aids typically take the form of a flowchart, commonly termed an ‘algorithm’. Emergency algorithms in the form of branched decision trees may be too complex for teams to navigate during the stressful, time-pressured setting of a medical emergency. It may be difficult for a team leader to allocate sufficient attention to the algorithm, coordinate the team, and perform technical tasks themselves during the emergency. There may be insufficient time to do all tasks, or the task switching involved may increase the demands of handling each the tasks.

We introduced two new designs of cognitive aids for anaphylaxis management during anaesthesia. The designs were a typical branched algorithm and a linear version based on the ‘DRSABCD’ (Danger, Response, Send for help, Airway, Breathing, CPR, Defibrillation) mnemonic used in basic life support. A simulation study was undertaken to determine which of the two designs anaesthetists and anaesthetic assistants believed supported their work best during an emergency. We hypothesized that participants would find the linear version easier to use during a simulated emergency than the more complex branched algorithm.

Methods: Human research approval was obtained from University of Queensland, Hunter New England Health and Monash Health ethics committees. Teams consisting of one senior and one junior anaesthetist plus an anaesthetic assistant (anaesthetic nurse or technician) were recruited from four major hospitals in two different Australian states. Each team participated in three intraoperative anaphylaxis emergency scenarios: one without a cognitive aid, one with the linear design of the cognitive aid, and one with the branched algorithm design of the cognitive aid.

The cognitive aids were designed to be as similar in content as possible with regard to the wording and representation of the information. Each cognitive aid consisted of two cards: an immediate response card and a refractory management card for when the initial management did not rectify the emergency and further measures were required.

At the completion of the scenarios the participants completed a questionnaire asking about the designs of the cognitive aids and the degree to which they helped or hindered performance in the scenarios.

Results: Of the 42 participants that expressed a preference, most preferred the linear design of the cognitive aid (33%, n=14) compared to the branched design (14%, n=6). Over half (52%, n=22) stated that either design was useful. Comments about the design and content of
the cognitive aids included the size of the font, level of detail of the text and how medication doses were expressed. Most participants reported that the cognitive aids helped them remember what to do (92%), outlined a strategy for them (90%) and helped them prioritise tasks (77%).

Discussion: Participants strongly preferred the linear version of the cognitive aid. The linear version of the aid was also associated with higher team performance scores (Marshall et al., 2014), particularly for communicating important information between team members. The subjective findings therefore corroborate the finding that teams are more effective when a linear design is used.

Clinicians' preference for a simpler design may reflect the higher cognitive demands of complex decision trees during clinical emergencies and clinicians' perception of how difficult decision trees are to use. This perception may result in team choosing to avoid aids with complex designs despite the evidence that complex designs improve outcomes over no aids at all.

These outcomes have important implications for the design of future cognitive aids for medical emergencies. Most cognitive aids are complex algorithms that may not support the clinicians and teams as effectively as linear designs. The present findings should be tested for other emergencies other than those reported here. Further work is required to determine how computerised cognitive aids such as algorithms on smartphones might affect team performance, and how acceptable they are to users.

Keywords: cognitive aids, medical emergencies, patient safety, checklist design

References