Interruptions, distractions and situation awareness in advanced display studies

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Background. Advanced monitoring displays can help anesthesiologists detect clinical events faster and improve their situation awareness of the patient[1]. However, anesthesiologists must be aware of more than just the patient's physiology. For example, if while monitoring the patient the anesthesiologist can detect errors made by other staff, then patient safety can be improved. Some displays help anesthesiologists perform multiple tasks better, but tests of handling multiple tasks are seldom part of display evaluations[2]. Recent research suggests that interruptions can make clinicians more prone to error[4]. We present an example of how anesthesiologists' management of an interruption can affect their situation awareness of non-patient but clinically relevant events.

Methods. We manually reviewed video recordings of 12 anesthesiologist participants from the Royal Adelaide Hospital who were presented with a "failure to check blood" event in a simulator study of head-mounted displays[3]. The event begins early in the scenario, where the patient develops hypovolemia and the participant (anesthesiologist) orders several units of blood. About 10 minutes later, the blood is delivered to the operating room. The anesthetic nurse (actor) sets up the blood on a drip stand and begins transfusion without first checking it against the patient. As the blood arrives at the operating room, the surgeon (actor) asks the participant to transfer the patient to the High Dependency Unit (HDU) after the procedure.

We classified participants' strategies for handling the surgeon's interruption into categories adapted from the taxonomy of distractions described by Collins et al.[4]: 1) Interruption: immediately organising the HDU transfer, 2) Multitasking: organising the transfer while concurrently setting up the blood, and 3) Deferred Task: agreeing to the transfer but temporarily deferring action. While reviewing the data, we saw need for a further category, 4) Blocking: immediately denying the request.

Strategy	# of participants	
	Detected	Missed
Interruption	0	2
Multitasking	1 (late)	0
Deferred Task	4	0
Blocking	5	0

Results. As the table shows, the only two participants who missed the event both immediately agreed to organise an HDU transfer and then became engaged in doing so (Interruption). One participant initially missed the event because he was organising the HDU transfer and directing the nurse to apply a pressure bag (Multitasking) and he only detected the event later after the transfer was complete. Four participants immediately agreed to the transfer, either performed or delegated the blood check, and then organised the HDU transfer (Deferred Task). The remaining five participants provided justifications for denying the surgeon's request and closed the conversation (Blocking).

Conclusions. Anesthesiologists' strategies for responding to interruptions and handling multiple tasks can directly affect their detection of clinically relevant events. Few studies of the impact of advanced displays have manipulated multi-tasking, interruptions and distractions[1] but effective displays should mitigate the effects of interruptions. Overall, broader test scenarios are needed to determine whether a display will affect anesthesiologists' awareness of safety-critical but non-physiological events in the operating room.

References:

[1] Görges, M., & Staggers, N. (in press). Evaluations of Physiological Monitoring Displays: A Systematic Review. *J Clin Monit Comput*. 2007.
[2] Watson, M., & Sanderson, P. (2004). Sonification Supports Eyes-Free Respiratory Monitoring and Task Time-Sharing. *Human Factors*, 46(3), 497-517.
[3] Liu, D., Jenkins, S., Sanderson, P.M., Leane, T., Watson, M.O., Russell, W.J. (2008). Simulator evaluation of head-mounted displays for patient monitoring. *STA Annual Meeting 2008*, San Diego, CA.
[4] Collins, S., Currie, L., Patel, V., Bakken, S., & Cimino, J.J. (2007). Multitasking by Clinicians in the Context of CPOE and CIS Use. *Stud Health Technol Inform*, 129, 958-62.