Assessment of user needs for a sepsis fluid management Artificial Intelligence tool

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SUMMARY

Artificial intelligence (AI) technology has the potential to support clinical decisions for sepsis fluid management. However, to ensure the full benefit of the technology is realised, a human factors approach, utilising a work system model, can be applied from the outset in parallel with the AI development to ensure the technology is created for the setting within which it will be integrated.

KEYWORDS

Sepsis, Artificial intelligence, User needs

Introduction

Sepsis occurs when a patient has an adverse response to an infection which can be life-threatening (Singer *et al*., 2016). The cornerstone of sepsis treatment, highlighted in international guidelines, involves a combination of antibiotics, vasopressors, and fluid administration (Evans *et al*., 2021). While it is accepted that fluids are necessary for treating sepsis, previous research has suggested that an excessive or insufficient fluid volume can harm a patient's recovery (Marik, Byrne and Van Harden, 2020). Therefore, an individualised volume based on the patient's clinical characteristics is recommended, which could be calculated with the support of artificial intelligence (AI) technology. However, research suggests that AI technology's performance may be reduced once implemented into healthcare because developers focus solely on technological development rather than how an AI tool would interact with the work system where it will integrate (Sujan, Pool and Salmon, 2022).

Human factors approaches can be applied to ensure that future AI technology is created for the chosen work systems and should be applied in tandem from the outset of development (Sujan, Pool and Salmon, 2022). In the first stage of this PhD, a scoping review was conducted on how previous research had applied a human factors approach to the AI lifecycle. One of the approaches found in the review that can be applied at the initial development is assessing user needs where the requirements within future work systems are understood. This includes understanding barriers, changes, or suggestions for the AI tool. Therefore, this study aimed to apply an assessment of needs approach to developing a sepsis fluid management AI tool (AI-SFM tool) for adult critical care.

Methods

Semi-structured interviews were conducted based on the extended Work System Model, which was developed by Salwei and Carayon in 2022, to understand how AI technology will interact with the healthcare work system. The model is made up of six components: AI technology, person(s), other tools and technologies, physical environment, tasks and organisation. A vignette of the AI-SFM tool was created to demonstrate how the proposed tool could manage sepsis fluid in adult critical

care. Interviews were completed with clinicians working in Scottish adult critical care from December 2022 to February 2023, where their current work system and how this may be impacted or changed by the AI-SFM tool were discussed. Data were collected and analysed using a thematic approach, using the extended Work System Model as a framework (Salwei and Carayon, 2022).

Results

Twenty clinicians from nine health boards participated (six trainee doctors, five pharmacists, four consultants, four advanced critical care practitioners, and one nurse). The main results suggested that in terms of the AI-SFM tool itself, participants felt that the technology would be useful in adult critical care but also provided suggestions for its development, including that it should be integrated into their current or future electronic platforms. Results aligned to the person(s) component showed that participants felt their current confidence and IT skills would be suitable for using the AI tool if it were easy to use. However, there was a perceived lack of general AI technology knowledge. Regarding the tools & technologies component, there were suggested variations in the use of paper or electronic tools and technologies. This variation was highlighted as a potential barrier to the AI-SFM tool's use due to the lack of consistency across and within hospitals. The physical environment was discussed, and participants felt the design of the critical care unit and the age of the hospital could be a barrier to the use of the AI tool, as older hospitals tended to lack the necessary space for new equipment. Data within the task's component showed that the sepsis fluid management process reported by participants could be synthesised into five high-level tasks: patient admission to adult critical care; assess patient in critical care; decide on fluid volume for patient; administer fluid to patient; and monitor patient after fluids given. Participants reported that using the AI tool in the future may increase workload. Finally, regarding the organisation component, participants highlighted that the organisation would need to facilitate changes, such as providing new equipment or changing culture, to improve the organisational readiness to use the AI-SFM tool.

Conclusions

While the AI-SFM tool may be useful in adult critical care, underlying environmental, technological and barriers associated with organisational readiness were identified within the work system, which could impede the integration of the AI-SFM tools into practice. Overall, the results from this study emphasised the benefits of applying a human factors approach early in the development of healthcare AI technology, as it will ensure that the tool is created for the users and their work system.

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