Patient education using augmented reality (AR) for patients treated with radiotherapy for pancreatic cancer

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Background:

Radiotherapy uses ionising radiation to target and kill cancer cells, relying on high-quality pre-treatment imaging for precise dose planning and delivery. Breath-hold techniques are used to improve image quality, target dose delivery, and minimise dose to healthy tissue. A review of the current literature identified a need for accessible patient-specific resources. This research aimed to develop and test an augmented reality (AR) mobile application to support patient education on the exhale-breath hold for pancreatic cancer radiotherapy patients.

Methods:

Using anonymised pancreatic cancer patient datasets, animated 3D models of thoracic and abdominal organs were digitally reconstructed to show organ motion during free-breathing and exhale-breath hold. Clinicians and radiotherapy-experienced patients were involved in the design of the mobile application (Unity, version 2022.3.19f1) that presented organ models and animation in life-size through AR. The application included 3 resources; 'Understanding the Radiotherapy Journey?' a resource outlining the imaging and RT process, including patient expectations prior to and during appointments; 'Patient Education for Upper Abdominal Cancers', a section equipped with patient-appropriate information and interactive 3D models for an enhanced AR learning experience; and 'BREATHE', a series of guided breathing exercises for patients. The application was evaluated by healthcare professionals (HCP) using survey methodology which build upon standardised questionnaires such as the Reduced Instructional Materials Motivation Survey (RIMMS) and System Usability Survey (SUS).

Results:

Twenty-four HCPs completed the testing and evaluation. The RIMMS survey yielded high user motivation scores of Attention (M = 4.55), Relevance (M = 4.79), Confidence (M = 4.79), and Satisfaction (M = 4.54) (figure 1). The System Usability Score (SUS = 83.96) suggested excellent usability (figure 2). User testing found that 87% viewed AR as having the potential to improve patient education with 100% supporting that AR should be explored further as an avenue for patient education.
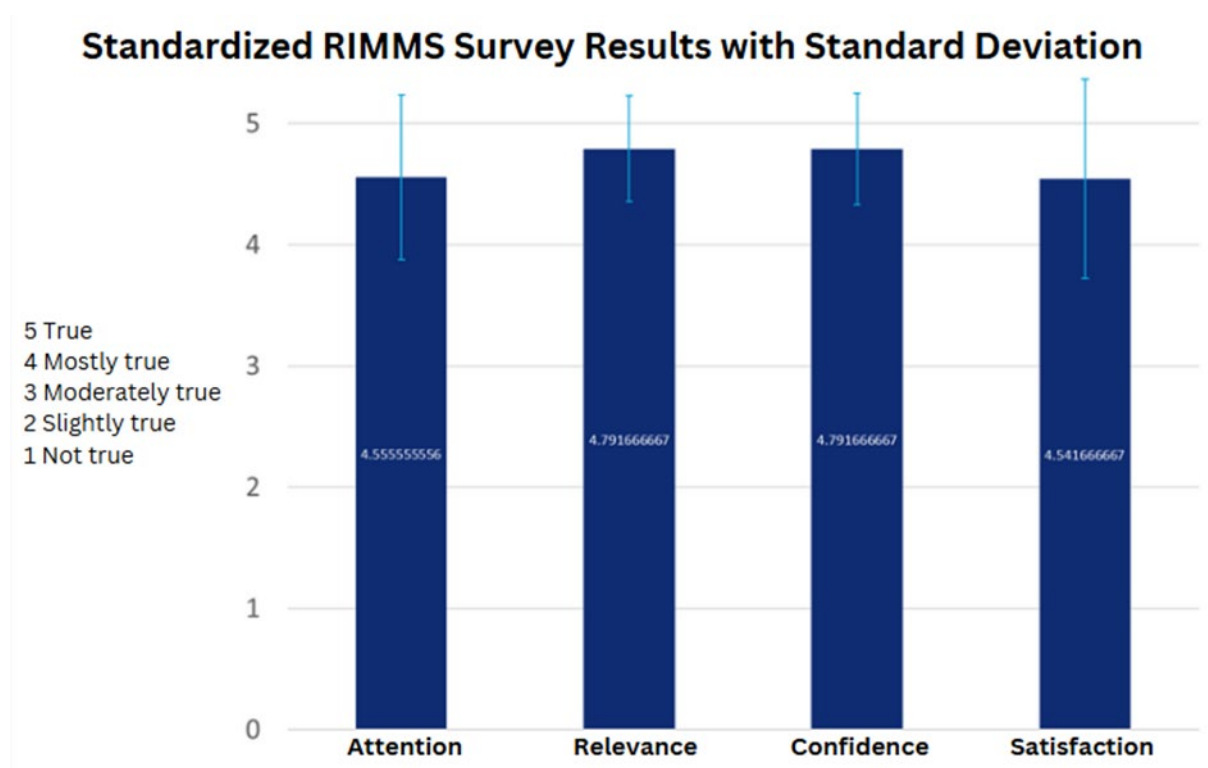

Figure 1: Results of the RIMMS inputs from twenty-four participants evaluating overall scores for Attention, Relevance, Confidence, Satisfaction
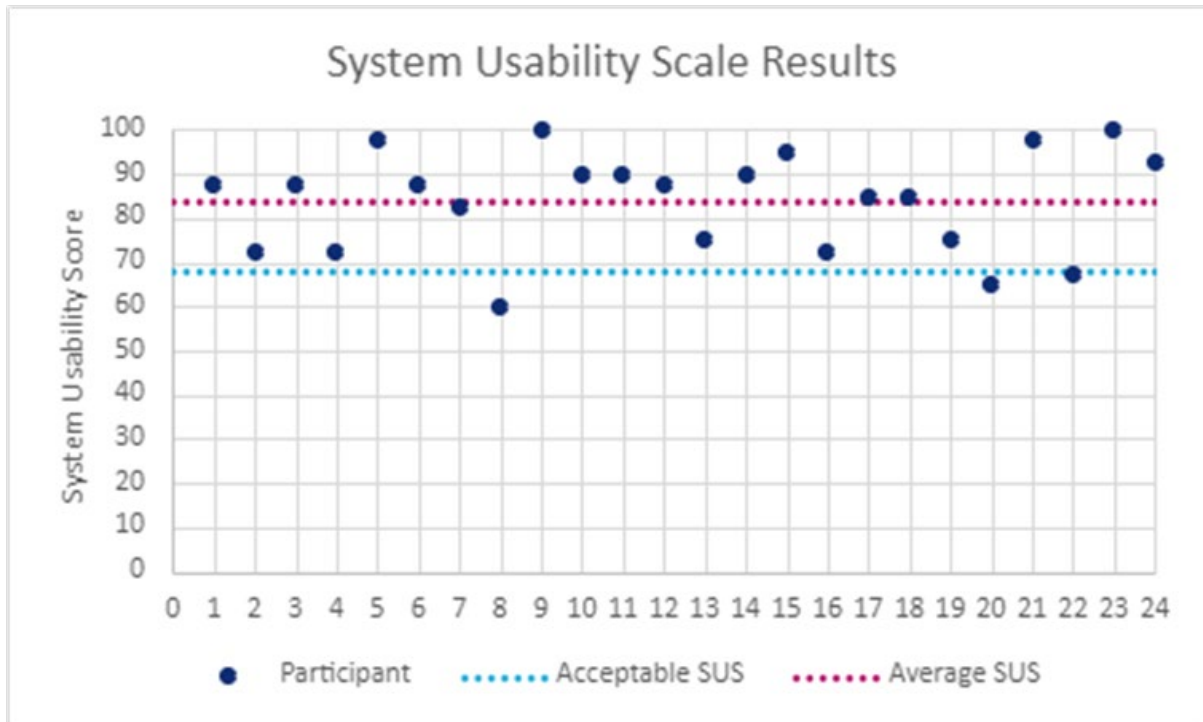
Figure 2: System usability scale results with individual responses displayed on a scatter diagram. Average SUS score of 24 participants (83.96) compared to an acceptable SUS score (68)

Conclusions:

The application effectively communicated the location and motion of upper abdominal organs, emphasising their relationship to the pancreas. AR applications could effectively communicate radiotherapy information to pancreatic cancer patients and serve as a model for future AR tools in radiotherapy.