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Title: Connecting resilience engineering to healthcare practice: Clinical engagement through a serious videogame
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Introduction: While Resilience Engineering (RE) is theoretically well developed and has high relevance to clinical work, it has had limited application in clinical settings. This is due in part to limited engagement with clinicians and difficulty translating theoretical concepts into practice. The aim of this study was to create a clinical engagement tool that can raise awareness of the value of RE in clinical work, and support clinicians to reflect on their own practices.

Method of game design: The chosen method of clinical engagement was to design a serious videogame. This method was chosen because serious games, those designed to educate rather than entertain, are known to specifically target behaviours and attitudes[1]. The serious game, Resilience Challenge (http://game.resiliencecentre.org.uk/), was based on RE principles, the findings of a scoping review on RE and healthcare, and clinical expertise. A focus group was held to design the game. It began by brainstorming clinical examples that corresponded with the four Resilience Potentials[2]. These examples were brought together and modified to create a unifying narrative of a patient's journey through the hospital. In the game design, special

1.   Iacovides, I. and A.L. Cox. *Moving beyond fun: Evaluating serious experience in digital games*. in *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems*. 2015. ACM.
2.   Hollnagel, E., *Safety-II in Practice: Developing the Resilience Potentials*. 2017, Oxford, UK: Routledge.

attention was paid to the accuracy of the graphics and the diversity of clinicians in the hospital.

Launch: The game is hosted on the Centre's website, and was shared online using social media, healthcare channels such as staff distribution lists, and safety blogs.

Method of evaluation: Resilience Challenge is being rigorously evaluated through several means. The first is the analytic data available through the game website, which indicates how many times the game has been played, for how long, and what responses were selected. The second is an online cross-sectional survey which is available through a link at the end of the game. The survey has branches for the general public and for healthcare clinicians. The survey asks demographic questions, Likert scale questions, and free text responses about the relevance of the game to one's clinical work. The third form of evaluation is play testing, where a participant plays the game with a researcher. The play testing includes brief pre and post interviews about the game, and think-aloud technique during gameplay.

Findings: At time of writing, Resilience Challenge has been played nearly 1,700 times, across the western world. The survey participants, including members of the public and clinicians (n=137), agreed almost universally that the game was engaging and they would recommend it to colleagues. 82% of clinician participants agreed or somewhat agreed that the game helped them to think through the impact of their actions on patient safety. 63% of clinician participants agreed that the game introduced them to the concept of organisational resilience. Clinicians were asked if the game enabled them to reflect on their clinical work, and if so, how. Thematic analysis of these free text responses identified the themes of system pressures, prioritising patients/connecting safety with patients, adaptations, and the 'right' answer in each scenario. The public focussed on the pressures faced by healthcare professionals and the graphics and mechanics of gameplay. Play testing findings are forthcoming.

Relevance: Resilience Challenge has demonstrated effectiveness as a teaching and reflective tool to engage clinicians about RE. There is great potential to scale the game, with several interested parties coming forward. These include a large, multi-centre teaching hospital in London, which is planning to use Resilience Challenge as part of its staff induction and annual training. Clinicians have found Resilience Challenge engaging and provocative, and this serious game presents an important medium to engage with clinicians, enable conversations about pressures and adaptations in clinical work, and transfer research findings to clinical practice.