Escape into patient safety: bringing human factors to life for medical students

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ABSTRACT

Background Patient safety is at the core of the General Medical Council (GMC) standards for undergraduate medical education. It is recognised that patient safety and human factors' education is necessary for doctors to practice safely. Teaching patient safety to medical students is difficult. Institutions must develop expertise and build curricula while students must also be able to see the subject as relevant to future practice. Consequently graduates may lack confidence in this area.

Method We used gamification (the application of game design principles to education) to create a patient safety simulation for medical students using game elements. Gamification builds motivation and engagement, whilst developing teamwork and communication. We designed an escape room—a team-based game where learners solve a series of clinical and communication-based tasks in order to treat a fictional patient while avoiding 'clinician error'. This is followed up with an after action review where students reflect on their experience and identify learning points.

Outcome Students praised the session's interactivity and rated it highly for gaining new knowledge and skills and for increasing confidence to apply patient safety concepts to future work.

Conclusion Our findings are in line with existing evidence demonstrating the success of experiential learning interventions for teaching patient safety to medical students. Where the escape room has potential to add value is the use of game elements to engage learners with the experience being recreated despite its simplicity as a simulation. More thorough evaluation of larger pilots is recommended to continue exploring the effectiveness of escape rooms as a teaching method.

BACKGROUND

Patient safety is the prevention of errors and adverse effects to patients associated with healthcare.[1] In recent years, a clear direction has been set by the General Medical Council (GMC) and Health Education England to prioritise education and training as the means to improve patient safety across healthcare systems (compare the evolution of the GMC's Outcomes for Graduates between 2015 and 2018.).[2–4] Training doctors to make patient safety their highest priority is at the core of the GMC's *Promoting Excellence for Medical Education and training* standards: 'Just as good medical students and doctors make the care of their patients their first concern, so must the organisations that educate and train medical students and doctors'.[5]

Closely aligned is the concept of 'human factors', defined in healthcare as 'enhancing clinical performance through an understanding of the effects of teamwork, tasks, equipment, workspace, culture and organisation on human behaviour and abilities and application of that knowledge in clinical settings'.[6] Human factors aid understanding of why error occurs and reduces the likelihood of future error through quality improvement and system redesign.[7] An understanding of human factors is necessary for doctors to practise safely and allows professional development through participation in quality improvement activity.[2 8] Understanding human factors is important for the shift in perspective it engenders as much as the theory taught—to understand error at a system rather than an individual level.[9 10] Organisational efforts to improve patient safety using human factors principles are more effective if staff from all groups and levels of seniority are able to contribute, including medical students and newly qualified doctors.[11–13]

PROBLEM

The WHO identifies 11 topics for patient safety curricula, including human factors, teamwork and communication.[8] However, providing effective teaching to medical students can be difficult. Institutions can be slow to adapt to changing expectations of undergraduate curricula. Barriers to teaching patient safety include finding educators with the requisite expertise, enthusiasm and willingness to be open about their own experience, as well as the need to meaningfully integrate the subject into a busy curriculum.[8 14] Another challenge is making the subject relevant to students, who may not yet recognise its importance to future practice.[14 15]

Consequently, curricula, teaching methods and time allotted to patient safety vary between institutions, with traditional classroom teaching remaining the most common approach.[4 16 17] The soft skills required to contribute to improving patient safety are often assumed rather than explicitly taught, and students are not given opportunities to develop communication and teamwork skills.[18] Though this variation is not unique to patient safety, it contributes to new graduates lacking confidence in their knowledge and skills and feeling unable to contribute to patient safety improvement.[14 19]

Some institutions have demonstrated success using experiential learning methods to engage students.[15 20–22] Experiential learning presents learners with new experiences, encourages reflection on those experiences and conceptualises them into new ideas, which can be tested in the world.[23] It facilitates rather than instructs, encourages learner autonomy and allows students to test and apply knowledge in practice.[24] Experiential learning methods have proven effective for teaching patient safety; they are favourably received and impart knowledge which can be applied in the workplace.[25]

The highest-profile experiential learning intervention in healthcare is simulation—allowing learners to master skills in a risk-free environment by creating experiences designed to mimic real clinical encounters.[26 27] However, simulation is often perceived as inaccessible due to cost or reliance on technology.[4] In fact, simulation is most effective not when it succeeds in recreating a physical environment, but when the skills required to succeed in a task are faithfully reproduced.[27]

METHOD

We sought to overcome some of these challenges with a low-tech, low-cost, but engaging simulation through gamification of learning. This application of game design principles to learning increases immersion in the learning environment and participants' engagement with concepts being taught, which in turn improves the learning experience.[28 29] This approach has other benefits: games which encourage active participation and collaboration to achieve shared objectives build teamwork and communication skills.[30] We aimed to create a learning environment which gaveto give students an appreciation of how the skills being taught are used in clinical settings to promote patient safety. We did this by creating an escape room.

Escape rooms are live-action team-based games where players work together to discover clues, solve puzzles and accomplish tasks to achieve a specific goal in limited time. Games are often set in fictional locations, incorporating storytelling elements to motivate players as the game progresses. Participation in escape rooms increases teamwork among clinicians.[31] Adapting the escape room format for clinical scenarios is effective for teaching clinical skills due to the active participation required to complete tasks and 'win' the game.[32–34] In this sense, escape rooms are simulations which aspire not to physical fidelity with the system being reproduced but create a high degree of the psychological fidelity required for students to learn and apply their knowledge.[27]

We created a session as part of a specialty choice module in patient safety for third-year medical students, delivered jointly by Imperial College London and Imperial College Healthcare National Health Service Trust. The module was offered 3 times over 1 year on a first-come-first-served basis. It was delivered to 19 students in groups of 6 to 7. A £90 cost was incurred for materials.

In our portable, suitcase-based escape room students work together to solve a series of challenges in order to diagnose and treat a patient within a 30 minute time limit. Progressing through the escape room requires students to complete a series of clinical tasks: making a diagnosis; calculating a National Early Warning Score (NEWS); looking up treatment in the British National Formulary; completing a drug chart to prescribe medication—all contained within the suitcase. These are familiar concepts to third-year medical students, though this experience using them is likely their first. Students seek advice from a hospital registrar and are prompted to use the situation, background, assessment, recommendation (SBAR) structured communication tool to deliver an assessment of the patient's condition. Correctly completing challenges allows students to progress through the scenario by obtaining a series of codes which open padlocks to suitcase compartments containing the next task. Codes entered incorrectly act as a source of feedback on 'clinician error'. Students were not prevented from making errors during the game but were provided with feedback to help them self-correct, an important aspect of this type of learning.[24 27] The escape room is won when the patient is treated without suffering avoidable harm.

Following the escape room, trainers facilitate an After Action Review (AAR) in which students are asked to reflect on their expectations of the escape room and compare these with the experience of taking part. AAR allows students to reflect as a group on their experience, explore the factors which contributed to their successful (or otherwise) progression through the game and identify their own learning points.[35] Classroom teaching is used to recap clinical and communication tools, using learning points from the AAR to motivate the need for good teamwork and communication. Students receive an introduction to the principles of human factors in healthcare and are asked to consider the avoidable errors which may have occurred during the escape room as well as strategies to prevent these in the future.

RESULTS

Students evaluated the session using a feedback form containing two outcome measures: 'did you gain new knowledge, skills or insights today?', and 'how confident do you feel that you will be able to apply what you learnt today in the future?' They were invited to comment on what they liked about the session, and what they would change.

All students (n=19) completed an evaluation form. The session was overwhelming positively received: 100% of students *agreed* or *strongly agreed* they gained new knowledge and skills and insights. 100% felt *confident* or *very confident* they would be able to apply what they had learnt in the future.

When asked what they liked about the session, every student chose the escape room, describing it as 'really enjoyable', 'interactive and engaging' and 'a good way to think about emergency situations in a low-pressure environment'. Suggestions for improvement focused on the latter parts of the session, with a strong desire to maintain the interactivity and teamwork of the escape room.

DISCUSSION

Participants' positive reaction to the session and agreement it had helped them to learn in a way that could be applied in future shows the potential of escape rooms as an experiential learning tool for teaching patient safety and human factors to medical students. The desire to win the escape room helped to build intrinsic motivation for tasks being simulated, which in turn builds a connection with the subject matter. Making links between students' experience in the escape room (including the experience of identifying and correcting errors) and the patient safety concepts being taught increased their appreciation of the importance of the subject.

The escape room has the potential to address the challenge identified in the literature of building students' motivation for this subject and recognising its value to future practice. The need for participants to work together to succeed allows students to develop communication and team working skills—something identified as a limitation of classroom teaching. The opportunity to practice in a risk-free environment which simulates the thinking and skills of a real scenario was received favourably by participants, and the confidence students reported may mitigate concerns about participating in patient safety improvement in future.

Central to the success of this intervention is AAR. Without the opportunity to reflect and to bridge the gap between experience and the concepts being taught, we do not learn as effectively.[23] Students responded positively to the escape room in part because they had structured time to debrief following their shared experience and to identify their learning points as a group. Opening the session with the escape room and AAR set an open, interactive tone to the session, and this made it easier to have more difficult conversations about human factors and clinician error later on.

Limitations

We note several limitations in the evaluation of our intervention. For our short pilot prototyping the concept, we limited evaluation to the first level of Kirkpatrick's evaluation model; learner reaction and satisfaction. We acknowledge the small sample size and the lack of both baseline measurement and comparison of findings with other teaching methods.

CONCLUSION

Our findings are in line with existing evidence demonstrating the success of experiential learning interventions for teaching patient safety to medical students. Where the escape room has the potential to add value is the use of game elements to engage learners with the experience being recreated despite its simplicity as a simulation.

A more thorough evaluation of larger pilots is required to explore effectiveness in comparison with other teaching methods, including longitudinal follow-up of retention of knowledge and confidence gained. Adapting the intervention for practising clinicians would allow easier assessment using higher levels of Kirkpatrick's framework, behavioural change in practice and impact on patient care.

REFERENCES

1. World Health Organisation. Patient safety. http://www.euro.who.int/en/health-topics/Health-systems/patient-safety/patient-safety
2. General Medical Council. *Outcomes for graduates (2018)*. London: General Medical Council, 2018.
3. General Medical Council. *Outcomes for graduates (2015)*. London: General Medical Council, 2015.
4. Health Education England. *Improving safety through education and training*. London: Health Education England, 2016.
5. General Medical Council. *Promoting excellence: standards for medical education and training*. London: General Medical Council, 2015.
6. Catchpole KR, Dale TJ, Hirst DG, *et al*. A multicenter trial of aviation-style training for surgical teams. *J Patient Saf* 2010;6:180–6.
7. Russ AL, Fairbanks RJ, Karsh BT, *et al*. The science of human factors: separating fact from fiction. *BMJ Qual Saf* 2013;22:802–8.
8. World Health Organization. *WHO Multi-professional patient safety curriculum guide*. Geneva: World Health Organization, 2011.
9. Catchpole K. Spreading human factors expertise in healthcare: untangling the knots in people and systems. *BMJ Qual Saf* 2013;22:793–7.

10. Waterson P, Catchpole K. Human factors in healthcare: welcome progress, but still scratching the surface. *BMJ Qual Saf* 2016;25:480–4.
11. Timmons S, Baxendale B, Buttery A, *et al*. Implementing human factors in clinical practice. *Emerg Med J* 2015;32:368–72.
12. Paterson-Brown S. Improving patient safety through education. *BMJ* 2011;342:d214.
13. Seiden SC, Galvan C, Lamm R. Role of medical students in preventing patient harm and enhancing patient safety. *Qual Saf Health Care* 2006;15:272–6.
14. General Medical Council. *First, do no harm*. London: General Medical Council, 2015.
15. Wong BM, Etchells EE, Kuper A, *et al*. Teaching quality improvement and patient safety to trainees: a systematic review. *Acad Med* 2010;85:1425–39.
16. Nie Y, Li L, Duan Y, *et al*. Patient safety education for undergraduate medical students: a systematic review. *BMC Med Educ* 2011;11:33.
17. Kirkman MA, Sevdalis N, Arora S, *et al*. The outcomes of recent patient safety education interventions for trainee physicians and medical students: a systematic review. *BMJ Open* 2015;5:e007705.
18. Leonard M, Graham S, Bonacum D. The human factor: the critical importance of effective teamwork and communication in providing safe care. *Qual Saf Health Care* 2004;13:i85–90.
19. Monrouxe LV, Bullock A, Gormley G, *et al*. New graduate doctors' preparedness for practice: a multistakeholder, multicentre narrative study. *BMJ Open* 2018;8:e023146.
20. Halbach JL, Sullivan LL. Teaching medical students about medical errors and patient safety: evaluation of a required curriculum. *Acad Med* 2005;80:600–6.
21. Flanagan B, Nestel D, Joseph M. Making patient safety the focus: crisis resource management in the undergraduate curriculum. *Med Educ* 2004;38:56–66.
22. Miller KK, Riley W, Davis S, *et al*. In situ simulation: a method of experiential learning to promote safety and team behavior. *J Perinat Neonatal Nurs* 2008:22:105–13.
23. Kolb D. *Experiential learning: experience as the source of learning and development*. 2nd edn. Upper Saddle River New Jersey: Pearson Education Inc, 2015.
24. Maudsley G, Strivens J. Promoting professional knowledge, experiential learning and critical thinking for medical students. *Med Educ* 2000;34:535–44.
25. England HE. *Evaluation of education and training interventions for patient safety*. London: Health Education England, 2016.
26. McGaghie WC, Issenberg SB, Cohen ER, *et al*. Does simulation-based medical education with deliberate practice yield better results than traditional clinical education? A meta-analytic comparative review of the evidence. *Acad Med* 2011;86:706–11.
27. Maran NJ, Glavin RJ. Low- to high-fidelity simulation - a continuum of medical education? *Med Educ* 2003;37:22–8.
28. Hamari J, Shernoff DJ, Rowe E, *et al*. Challenging games help students learn: an empirical study on engagement, flow and immersion in game-based learning. *Comput Human Behav* 2016;54:170–9.
29. Nevin CR, Westfall AO, Rodriguez JM, *et al*. Gamification as a tool for enhancing graduate medical education. *Postgrad Med J* 2014;90:685–93.
30. Romero M, Usart M, Ott M. Can serious games contribute to developing and sustaining 21st century skills? *Games Cult* 2015;10:148–77.
31. Zhang XC, Lee H, Rodriguez C, *et al*. Trapped as a group, escape as a team: applying gamification to incorporate team-building skills through an 'escape room' experience. *Cureus* 2018;10:e2256.
32. Hermanns M, Deal B, Campbell AM, *et al*. Using an "Escape Room" toolbox approach to enhance pharmacology education. *J Nurs Educ Pract* 2017;8:89–95.
33. Adams V, Burger S, Crawford K, *et al*. Can you escape? Creating an escape room to facilitate active learning. *J Nurses Prof Dev* 2018;34:E1–5.
34. Kinio AE, Dufresne L, Brandys T, *et al*. Break out of the classroom: the use of escape rooms as an alternative teaching strategy in surgical education. *J Surg Educ* 2019;76:134–9.
35. Sawyer TL, Deering S. Adaptation of the US army's after-action review for simulation debriefing in healthcare. *Simul Healthc* 2013;8:388–97.