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# Choose your own story: combining interactive voting technology and high-fidelity patient simulations in the lecture theatre, for large group preclinical medical education

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**INTRODUCTION**

A major challenge faced by undergraduate medical students is application and integration of their basic science knowledge into clinical practice.<sup>1</sup> Such integration forms a crucial component in the effective evaluation and management of patients.<sup>2</sup> However, medical schools often struggle to provide sufficient early clinical experience to facilitate this process, particularly in the first, predominantly preclinical, years.<sup>3</sup> High-fidelity patient simulation provides a unique opportunity for students to apply learned principles in a safe, controlled learning environment, and can encourage a deeper level of understanding through active and experiential learning.<sup>4</sup> Yet, medical student use of simulation in the UK is primarily conducted in small groups in the later, largely clinical, years. A limited number of institutions use lecture theatre-based simulations with the class principally observing.<sup>5</sup> This paper describes the development of interactive lecture theatre-based simulations which enable large cohorts of preclinical medical students to apply their scientific knowledge to clinical scenarios.

SimMan is a high-fidelity patient simulator who can be programmed to display a wide range of physiological and pathophysiological signs and respond appropriately to treatment, be it physical, for example, cardiopulmonary resuscitation, or therapeutic, for example, administration of drugs. This project aimed to incorporate SimMan into preclinical pharmacology teaching, to build a deeper level of understanding of the subject and place the patient at the heart of the learning experience. However, with over 200 students in each year group, a number of challenges arose. First, the classic small group simulation approach was hampered by lack of capacity, mainly timetabling constraints and access to SimMan. Consequently, simulations were developed to be delivered en masse to the whole year group. Using this approach, we had to mitigate a potential lack of engagement from the whole class if only the tutor and/or a few students controlled the scenario.

**METHODS**

A range of interactive simulated medical emergencies were created for delivery in the lecture theatre. All scenarios ran for approximately 15 min within 1 h sessions, with the remainder of the session dedicated to traditional lecture style delivery of learning outcomes. To enable the entire class to engage in clinical decision-making, split screen and

interactive voting technologies were employed. One of the screens projected the physiological read-outs from SimMan such as his blood pressure, ECG heart trace and oxygen saturation; the other screen was linked to a TurningPoint interactive quiz (figure 1). Each student was supplied with a TurningPoint handset. At a series of key clinical points throughout the scenario the students were asked to vote individually and anonymously on the most appropriate course of action (eg, initial patient management steps, which drug should be administered). The option with the most votes (whether or not this was the correct management option) was applied to SimMan and the students then observed the physiological effects this had in real time.

Scenarios developed and delivered to date include an acute asthma attack, anaphylaxis and sepsis. Clinical teaching fellows portrayed the emergency doctors, paramedics and nurses. A microphone was attached to SimMan to project his breathing throughout the lecture theatre and a colleague off-stage provided a voice for SimMan in response to questioning. The simulations were followed by a short debrief in class where the consequences of the choices were explained along with explanations as to the correct course of action. A detailed debrief handout was distributed to support independent and further study. There were many learning opportunities afforded by this approach outside of learning the basic pharmacology principles. For first year students, it was the first time they had seen a vital signs monitor, so we orientated them to the screen with questions such as 'What does SpO<sub>2</sub> stand for? What are the normal levels for this?' The scenarios then incorporated general life support principles such as the ABCDE approach to patient management.

**RESULTS**

Online end of unit evaluation of this innovation has been positive. Three hundred and ninety-five of the 511 respondents (76%) agreed/strongly agreed with the statement 'The use of SimMan enhanced my learning experience' measured on a five-point Likert scale (96% response rate). Thematic analysis of free-text qualitative feedback uncovered two main themes:

1. The simulations demonstrated the effects of drugs in a patient-centred manner.

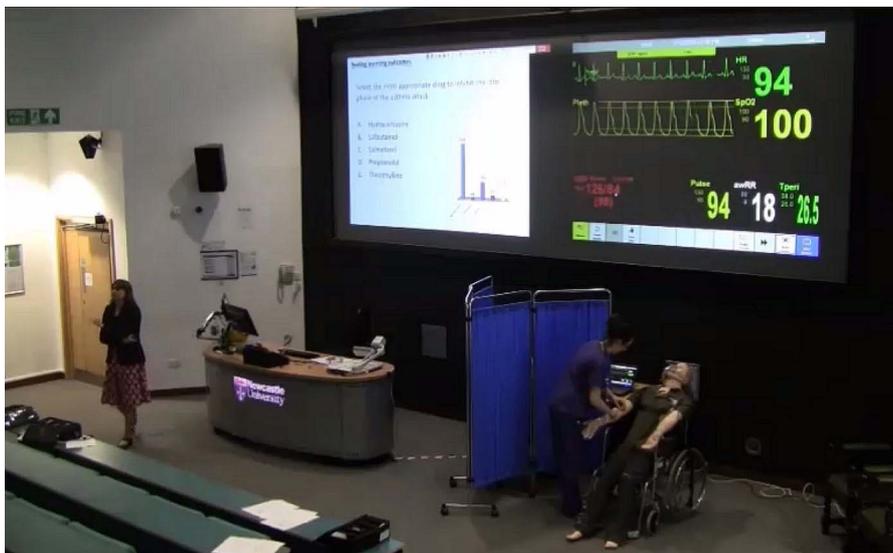


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**Figure 1** Still image taken from a video recording of a SimMan simulation in the lecture theatre illustrating the combination of simulation with interactive response technology. Students each have a TurningPoint handset and vote anonymously on the appropriate course of action in response to a series of clinical choices.

2. The simulations enabled students to see how the content of the course applied to clinical practice.

An example of feedback illustrating this latter point is: ‘The lecture using SimMan at the end was really good, especially using TurningPoint so that we could try to ‘treat’ SimMan. It kept the lecture clinically focussed and enabled us to see how the information would come in useful in practice’. Simulations where SimMan died, for example, after administration of 5 mL 1:1000 intravenous epinephrine for anaphylaxis, provided particularly memorable learning experiences. Feedback on this particular encounter included: ‘SimMan...cemented my learning on this topic and it made the entire lecture very memorable, I can still remember the entire SimMan session a year on’.

## DISCUSSION

A number of practical learning points have been drawn through development of this project. It is essential to conduct a full rehearsal in situ in advance of each session to troubleshoot electronic or software issues. Success also depends on training of the clinical teaching fellow assistants. They should be briefed on the prior level of knowledge of the students so as to highlight the pertinent clinical factors without overcomplication. Development of individual SimMan-based revision sessions, not linked to a particular lecture, would allow more time to be spent debriefing in class to enable greater exploration of the clinical learning points in the scenarios. For institutions without access to a SimMan, the scenarios could work well with a highly affordable patient monitor app such as SimMon.

In conclusion, engagement of students from the very first years of their medical education with realistic clinical scenarios will contextualise the importance of basic science principles.<sup>1 2</sup> The more frequently students are guided through the clinical

decision-making processes surrounding the application of drugs the more prepared they will be for practice and the more likely they are to provide a higher quality of care when they encounter real patients.

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