Get Your Head in the Game: The Use of Virtual Reality Simulation to Teach Medical Students the Management of the Acutely Unwell Patient

Dr Emma Lewin, Dr Dan Richardson

Vatsala Mishra, Eleni Parha, Adnan Mohamed, Sophia Bashir, Sherene Howard-Walker

Simulation Department

Barts Health NHS Trust

What is Virtual Reality Simulation?

- Computer-generated 3D image/environment that can be interacted with

- Headset with integrated displays which creates an immersive 3D image that looks realistic

- Head-tracking – changes the field of vision as the player turns their head

- Speakers in headset for realistic sound

Background

- Although Virtual Reality (VR) simulation is increasingly used as a tool in medical education, particularly in anatomy and surgery, more evidence is required on its application to undergraduates

- Due to the impact of the COVID-19 pandemic on clinical placements, final year students reported reduced confidence in managing patients and reduced exposure to a variety of conditions

- Additionally, third year students had reduced clinical placement days due to large student numbers
  - This is likely to increase the issues described above as a result of reduced exposure

- Virtual Reality Simulation was suggested as a solution to these issues

Aims

- To evaluate whether virtual reality simulation can be used as a tool in undergraduate medical education
  - To increase confidence in the management of the acutely unwell patient
  - To consolidate knowledge from CBL tutorials
- To assess the benefits and disadvantages of virtual reality simulation
- To evaluate the scope of potential uses of virtual reality simulation and its feasibility in undergraduate medical education
- Evaluate if there was any difference in responses depending on stage of training
- To explore the logistical challenges of delivering a VR Sim Programme

The Scenarios

- We used the Oxford Medical Simulation Virtual Reality programme
- There were a number of scenarios available to choose from
- We specifically ran scenarios which students had previously had tutorials on
- This included
  - Anaphylaxis
  - Bowel perforation
  - Diabetic Ketoacidosis
  - Hyperkalaemia + Acute Kidney Injury
  - Myocardial infarction
  - Pancreatitis
  - Pulmonary embolism
  - Sepsis
  - Upper GI Bleed

Methods

- Dedicated one-off VR sessions were run with groups of 3rd year (first clinical year) and 5th year (final year) medical students at St Barts Hospital, Royal London Hospital, Newham Hospital and Whipps Cross Hospital

- Groups of up to 7 students, either as a one-ff drop-in session or integrated into regular timetabled teaching

- 15 minute scenario with 15 minute debrief; different scenario combinations for each group

- Each student participated in one to two scenarios and observed the rest

- Students were asked to complete a pre- and post-session questionnaire

- The questionnaire included a mixture of qualitative/quantitative questions on:
  - Confidence in A to E assessment
  - Confidence in management of specific condition
  - Skills used/developed in the VR simulation
  - Suggested improvements for the session

- The mean was calculated for quantitative questions (out of 10)
  - Where responses were collected before and after the session, the average change was calculated and assessed for significance using a paired t test

- Qualitative responses underwent thematic analysis for common themes

Questions asked…

- Overall, how useful did you find this session?
- Overall, how enjoyable did you find this session?
- How confident do you feel with your A to E assessment? (Pre-session)
- How confident do you feel with your A to E assessment? (Post-session)
- How confident do you feel with managing [Insert scenario]? (Pre-session)
- How confident do you feel with managing [Insert scenario]? (Post-session)

Questions asked…

- Are there any skills that you thought the VR simulation particularly helped you to develop?

- How do you think VR simulation can be used in your training?

- What was realistic/unrealistic about VR simulation?

- What did you like/dislike about VR simulation?

Results- Quantitative

67 students participated in the sessions
Feedback was received from
14 5th year students (100%)
33 3rd year students (62%)

Question	Y3 Average (/10)	Y5 Average (/10)	Overall Average (/10)
How confident do you feel with your A to E assessment? (Pre-session)	6.8	6.79	7
How confident do you feel with your A to E assessment? (Post-session)	8.3	8.14	8.31
Change	+1.5 ⭐	+1.35 ⭐	+ 1.31 ⭐
Overall, how useful did you find this session?	9.55	8.71	9.3
Overall, how enjoyable did you find this session?	9.72	9.43	9.64

⭐ Statistically significant

Results- Quantitative

Confidence level in managing scenario	Pre-Session Average (/10)	Post-Session Average (/10)	Average Change	
Anaphylaxis (33)	6.1	7.9	⭐	+1.8
Bowel perforation (30)	4.9	6.6	⭐	+1.7
Diabetic Ketoacidosis (18)	4.8	6.1	⭐	+1.3
Hyperkalaemia + Acute Kidney Injury (24)	4	5.9	⭐	+1.9
Myocardial infarction (21)	4.5	6.3	⭐	+1.8
Pancreatitis (22)	5.1	7.1	⭐	+2.0
Pulmonary embolism (30)	4.3	6.1	⭐	+1.8
Sepsis (19)	5	6.5	⭐	+1.5
Upper GI Bleed (38)	3.7	5.8	⭐	+2.1

Results- Qualitative- Skills Developed

- A to E assessment and improved structure

- Completing a full patient assessment and management

- Problem solving / critical thinking

- Diagnostic/clinical reasoning

- Interpreting investigations

- Multitasking

- Working under pressure

Results- Qualitative- Potential Uses in Curriculum

- Supplemental method of practising A to E assessments of acutely unwell patients
- Practising scenarios that students may not see on clinical placement
- Practising scenarios that are difficult to simulate with a mannequin
- Supplement traditional simulation
- Consolidation of Case-Based Learning sessions
- Developing clinical reasoning/increasing confidence in decision-making
- Revision
- Formative assessment for development and learning
- Transition between theoretical knowledge and real clinical practice

Results- Qualitative- Pros and Cons

Pros	Cons
Safe environment to practice emergency scenarios	Limited use of communication skills
Guided/supported setting	Limited use of practical skills
Can be practised independently	Having options to select is unrealistic
Fun	Difficulty familiarising with platform initially
Multiple scenarios in one session (15 min scenarios)	VR can be disorientating
Interactive / Engaging	Currently only one student can participate at once
Realistic patient presentations and management options	Scenario does not always fully respond/adapt to actions taken by student
Different/novel learning modality	Risk of being taken less seriously due to game element
Encourages complete management of an unwell patient	
Enjoyable and efficient method for revision/consolidation	

Discussion

- Feedback for the use of VR in these sessions was overwhelmingly positive
- 3rd year students had a more positive experience than 5th year students
- It is a highly acceptable and enjoyable educational method for students which encourages independent assessment and decision-making
- Students valued the debrief following the simulation
- There are still some limitations to the technology which mean it is not as useful for developing communication and practical skills

- Limitations:

Limitations

- Novelty bias

- Not all students attended the sessions and not all third year students completed the feedback forms which could skew the results

- Assessing self-rated confidence is subjective and does not evaluate longevity of impact

- Feedback questionnaire didn't differentiate between satisfaction with the technology and satisfaction with the learning objectives

Implementation and Challenges

- Not all faculty were confident using the VR headsets and software even after a training session
- Deploying the VR programme had several logistical road-blocks from our ICT department, necessitating a workaround using the eduroam wifi
- Student response/perception
- Occasional technical difficulties were disruptive when incorporated into pre-arranged tutorials
- Room and faculty availability
- Strong support from medical school faculty for wider implementation

Conclusions

- Students overwhelmingly enjoyed this method of teaching
- Although this project focussed on managing acute scenarios, VR encourages students to develop a number of key skills
- Evaluation suggests that it can be used, alongside traditional simulation, to consolidate clinical knowledge and improve confidence in diagnosing and managing acute conditions independently
- It could have a role in facilitating the transition from pre-clinical to clinical practice and bridging experiential gaps from clinical placement
- A statistically significant improvement was demonstrated in confidence levels for A to E assessments and management of all simulated clinical conditions

Next steps...

- Integrate into curriculum, particularly for third years
  - As a supplement to traditional A to E simulation and tutorials
- Evaluate long-term data on VR and the impact of regular use on effectiveness and longevity of benefits
- Use objective measures of learning (e.g. Pre- and Post-session MCQs)
  - To ensure increase in confidence levels is justified
  - New feedback form- divests the VR experience from the clinical learning

References

Thank you!

Any Questions or comments:

emma.lewin2@nhs.net