Virtual Reality in Medical Education:
Utilizing today's technology for tomorrow's healthcare

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What is virtual reality?
Immersive Technology

- Virtual Reality
- Augmented Reality

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Opportunities for VR in Medical Education

- **Medical Students**
  - Increase disease state awareness
  - Practice new techniques risk-free
  - Distract from painful or lengthy procedures
  - Increase empathy and understanding

- **Physicians**

- **Patients**

- **Caregivers**

Opportunities for VR in Medical Education

- Virtual Surgery – Osso VR
  - Pick-up and use tools naturally with a high level of precision
  - VR trained users performed surgery twice as well as non-VR trained individuals, as measured by the Global Rating Scale
  - Incorporated into medical residency training programs at top medical schools
  - Adaptable to any surgical technique

“When 30 percent of residency graduates still can't do the job they spent nearly a decade preparing for, something needs to change.”

- Justin Barad, MD, OssoVR CEO/Founder
Opportunities for VR in Medical Education

• Virtual Patients
  • Virtual patients complete with personalities and clinical case scenarios
  • Allow physicians to practice discussing difficult topics such as mental illness, sexual abuse, or substance abuse
  • Boost physicians’ skills and confidence
  • Increases likelihood of engaging in difficult conversations
  • Simulation scores clinicians on their performance
  • Allows for distance learning
  • Adaptable to unique clinical scenarios

Kuehn, B. M. (2018) *JAMA* 319, 756–758; Photo licensed under CC BY-NC
Research Studies
Virtual Reality for Hospitalized Patients

Study Design
- Adults admitted to Cedars-Sinai Medical Center, Los Angeles
- 4-month study period in 2015
- Cognitive de-brief interview

Available VR Programs
- Paint Studio
- TheBluVR
- Cirque du Soleil
- Tours of Iceland

Virtual Reality for Hospitalized Patients

Results

86% reported positive experiences
- “Good distraction...welcome distraction...fun detour. Because it’s boring here in the hospital.”
- “It provides a separation from what’s going on. Difficult to verbalize how.”
- “Got away from being here in the hospital. Who wants to be here? It improved my mood.”

7% reported negative experiences
- “The headset was uncomfortable and hard to focus with the dial. The nose part was causing me pain, and I could not fully enjoy it.”
- “This was a new experience for me. But I know there are now holograms you can see in front of you, so this technology is already outdated.”
- “Anxious about getting dizzy during the experience, even though I didn’t feel that way.”

Virtual Reality for Hospitalized Patients

Results

• Only 5.9% of screened adults were willing and able to participate
• 57% chose Tours of Iceland
• Preferred 10 min videos
• 75% believed the experience could improve pain by means of distraction

Future Directions

• Evaluate patient knowledge and beliefs about VR to better understand why some patients are unwilling to use VR
• “Virtualist Consult Service” could be beneficial for hospitalized patients

Virtual Reality vs Paper-based Learning

Study Design

- Randomized controlled design study conducted in March 2017
- 1st and 2nd year medical students from the University of Saskatchewan
- Multiple-choice pre-test and post-test questions assessed the participants’ ability to visualize relations of structures in 3 dimensions
- Follow-up survey to assess student satisfaction with the learning experience
Virtual Reality vs Paper-based Learning

Results

- 64 participants (31 VR, 33 paper-based)
- Similar demographics (age, sex, medical school year, etc.)
- VR group showed greater improvements than paper-based group
  - Increased accuracy on post-intervention test
  - Improved retention on 7 day post-intervention test


<table>
<thead>
<tr>
<th>“This method should be used in the curriculum”</th>
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<tr>
<td>VR: 94% Strongly Agreed</td>
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<th>“I feel less afraid with the complexity of neuroanatomy”</th>
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<td>VR: 81% Strongly Agreed</td>
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Conclusions

1. Training utilizing VR improved knowledge attainment and retention of neuroanatomy compared to paper-based training
2. VR training may increase engagement and motivation to study
3. Useful supplement to classic medical education

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VR Training for Paraplegic Patients

• Study Design
  • Immersive VR uses EEG to control avatar with visuo-tactile feedback
  • Treadmill training with brain-controlled sensorized robotic exoskeleton
  • 8 paraplegic patients with spinal cord injury (>1 year)
  • 12 month Walk Again Neurorehabilitation Program

VR Training for Paraplegic Patients

• Results
  • Improvement in voluntary muscle control below the SCI
  • Improved tactile, proprioceptive, vibration, and nociceptive perception
  • Improved gastrointestinal and bladder function
  • Improvements noticeable at 7 months, peaked at 10 months

VR for Empathy and Bedside Manner

• “In My Shoes” seizure experience

• Programs at national events:
  • American Epilepsy Society
  • American Academy of Neurology
  • Neurocritical Care Society
  • Epilepsy Foundation

• Programs for local stakeholders:
  • Medical schools
  • Private practices
  • Physicians, nurses, staff, etc.
## UCB/VCU Jane VR Teaching Collaboration

### Patient Insight
- 1st visit to doctor is a defining factor of patient experience
- Fostering empathy in physician-patient relationships has been associated with higher patient satisfaction & better patient health outcomes

### Strategic Fit
- Aims to improve epilepsy patient experience and outcomes by augmenting the empathetic education of tomorrow’s epilepsy healthcare leaders

### Collaborative Actions
- Co-conduct a study that objectively evaluates the value of the Jane VR when it is combined with a scheduled lecture series
- Jane VR will be scheduled regularly throughout the semester with sessions including 10-15 3rd year medical students during their Neurology rotation
- Pre- and post-test questionnaire will be completed by the students

### Stakeholder Partners
- VCU faculty who deliver lectures on seizures

### Patient Value Impact
- Improve epilepsy patient experience and outcomes by increasing physicians’ awareness of their patient’s journey

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*Post, J. & Siano J. (2018) Piedmont Ecosystem*
Considerations & Conclusions
Considerations for Utilizing Virtual Reality

- Participant may experience cybersickness, headaches, or technological challenges
- Students may feel overconfident
- Technology will require significant up-front costs
- Technology may require dedicated technical staff to maintain equipment and programs
- Standards for uniform GME training of medical students are needed

Conclusions

Virtual reality has a wide range of applications in medical education.

Virtual reality has shown efficacy in studies of inpatients and medical students.

Virtual reality technology remains unfamiliar and uncomfortable for some.
Questions?

Thank you for your attention


