

## Enhancing Brachytherapy Education with Immersive Virtual Reality (VR) Video Technology

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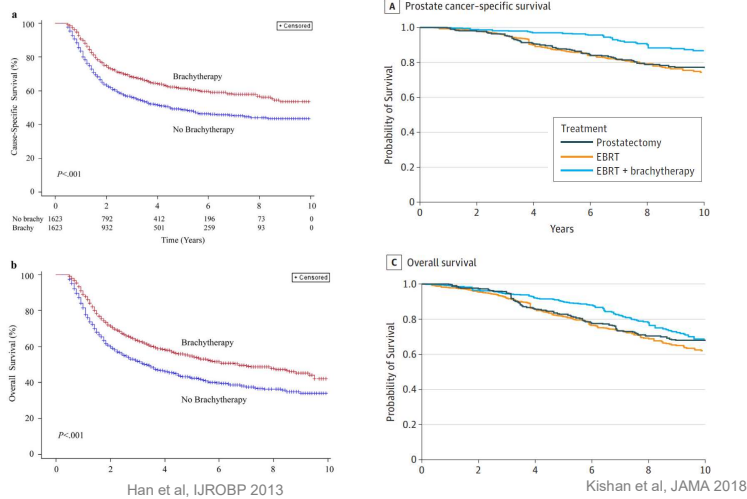


## Disclosure

- Grant, travel expenses, and honoraria from Varian Medical Systems
- Consulting agreement with Boston Scientific



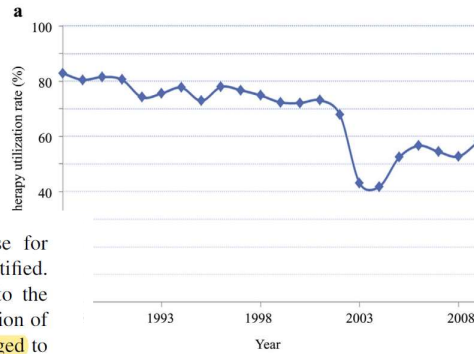
## Brachytherapy Improves Survival



## Brachytherapy Utilization & Need for Real-Time Training

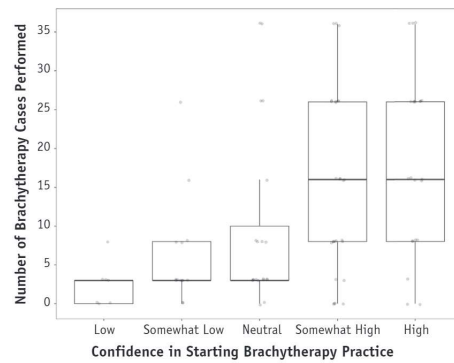
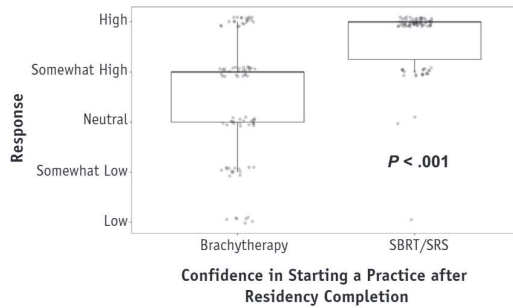
- ▶ Brachytherapy utilization is declining
  - Substantial decline for cervical cancer patients
  - Real-time educational programs is needed for comfort and proficiency

In conclusion, a significant decline in brachytherapy use for cervical cancer patients treated in the United States was identified. The decline in brachytherapy utilization may be related to the decreasing incidence of cervical cancer and increased adoption of alternative treatment techniques. Physicians are strongly urged to utilize brachytherapy whenever possible, and to participate in real-time educational programs to ensure comfort with performing this critical aspect of cervical cancer treatment. In those centers without brachytherapy facilities, patients with locally advanced cervical cancer should be referred to a center of excellence.



## Brachytherapy Training: How Are We Doing?

- ▶ Current brachytherapy training during residency is limited
  - Major barrier is identified as low institutional case load
  - In-person training can be significantly impacted, e.g. COVID-19
  - Virtual training using simulation is much needed



Marcrome et al, UROBP 2018

## Brachytherapy Training

### Challenges

- ▶ Very few high-volume centers to provide training
- ▶ Training is resource intensive
  - Similar to surgical training
  - Requires 1-on-1 training during actual patient encounters

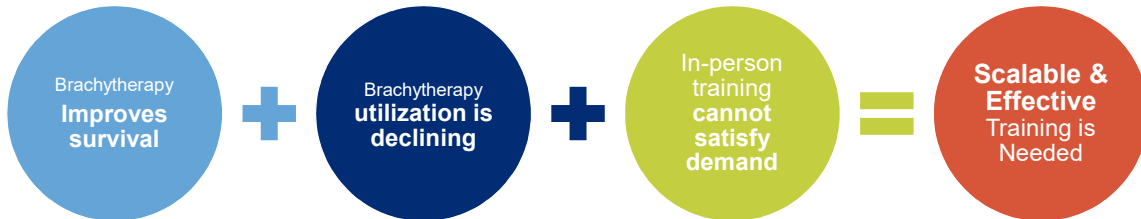
### Opportunity

- ▶ Create on-demand immersive training platform
  - Beneficial for both resident physicians and attendings who needs a refresher
  - Portable, distributable
  - Viewer can choose where to look by using natural head movement



<https://www.gocomics.com/freerange/2017/04/19>

## Why Virtual Training?



## Producing VR Education Video for Brachytherapy

- ▶ Consumer VR cameras is well suited
  - Cost < \$500
  - **Small and compact**, perfect for OR setting
  - **Simplified** post-production workflow



## Deliver VR Education Videos via Multiple Platforms

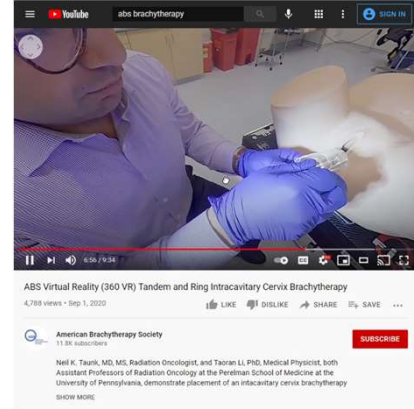
- ▶ Multiple immersive VR video delivery platforms can be used as needed



~ \$400



~ \$20 + Smart Phone



Free

## Post-Production: Virtual Displays to Enhance Training

- ▶ Virtual Displays as a unique advantage
  - VR video allows for user to choose where to look at by themselves
  - A lot of space around the camera is available
  - This enables possibility for placing educational contents at virtually anywhere in the room



## Educational Outcome – Oculus VR Headset

- ▶ 15 residents completed a pre-VR simulation questionnaire and a post-VR simulation questionnaire
  - Gauged engagement, interest, confidence, willingness to repeat procedure independently
  - All based on previously published or validated questionnaires



## Educational Outcome – Oculus VR Headset

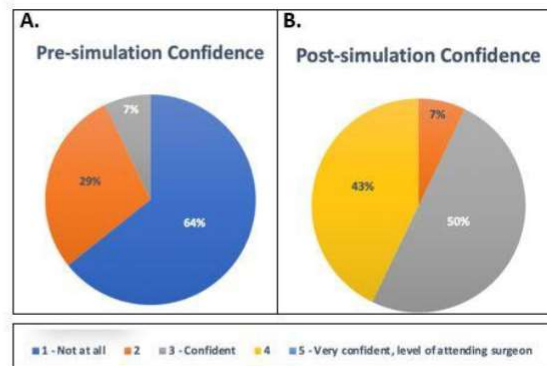
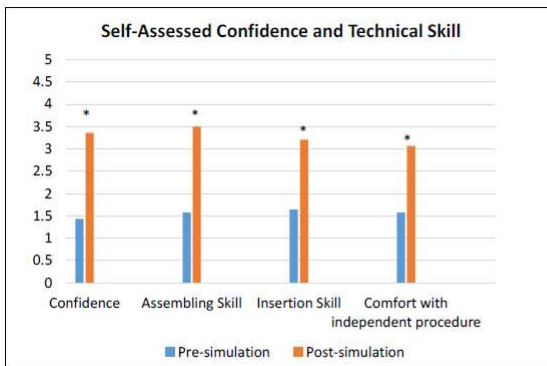


Figure 3 Confidence level comparison between pre- and post-VR-simulation on performing T&R applicator placement.

Taunk et al, Brachytherapy, 2021

## Educational Outcome – Oculus VR Headset

### ► Very Positive Feedback about VR (verbatim)

- I thought the point of view of the VR was perfect. Literally over the shoulder.
- I really enjoyed this VR learning and training for GYN brachytherapy. I would say I feel more comfortable and more knowledgeable about the procedure because of this session.
- I liked that I could pause and rewatch any confusing parts
- Very engaging, novel, and fun. Gave me a sense of being in the room. Very worthwhile.
- \*\*\*I had a tough time initially with the oculus head set. I didn't know that I had to turn around in order to see everything
- VR is very easy to access and very helpful to learn the whole procedure.

Taunk et al, Brachytherapy, 2021

## Educational Outcome – Cardboard vs. Oculus

### ► Is low-cost cardboard equally effective?

- Cardboard: \$20 + smart phone
- Oculus: \$400 standalone

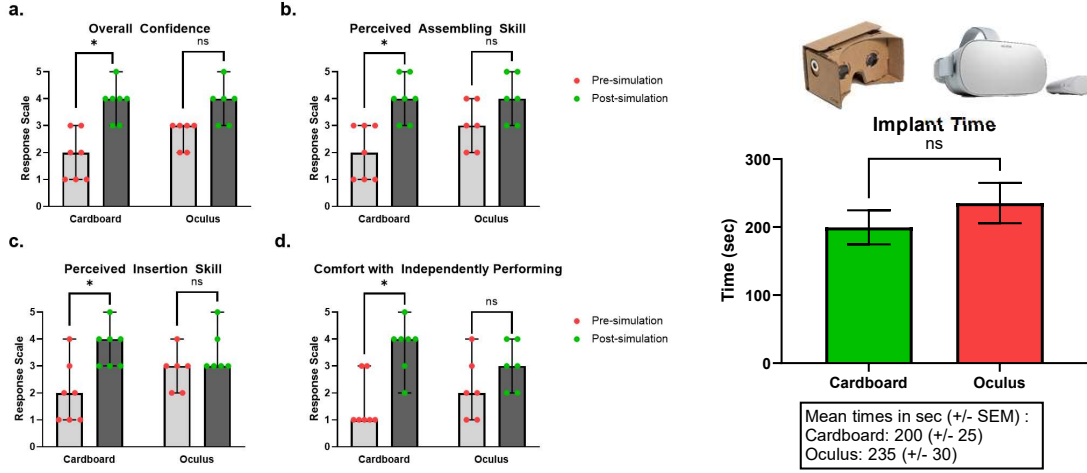
### ► Randomized Test

- PGY 2-5 resident randomized to cardboard and Oculus
- Complete pre-training survey
- Unlimited access to VR video on one platform for 6 weeks
- Resident perform applicator assembly and insertion on pelvic simulator
- Complete post-training survey



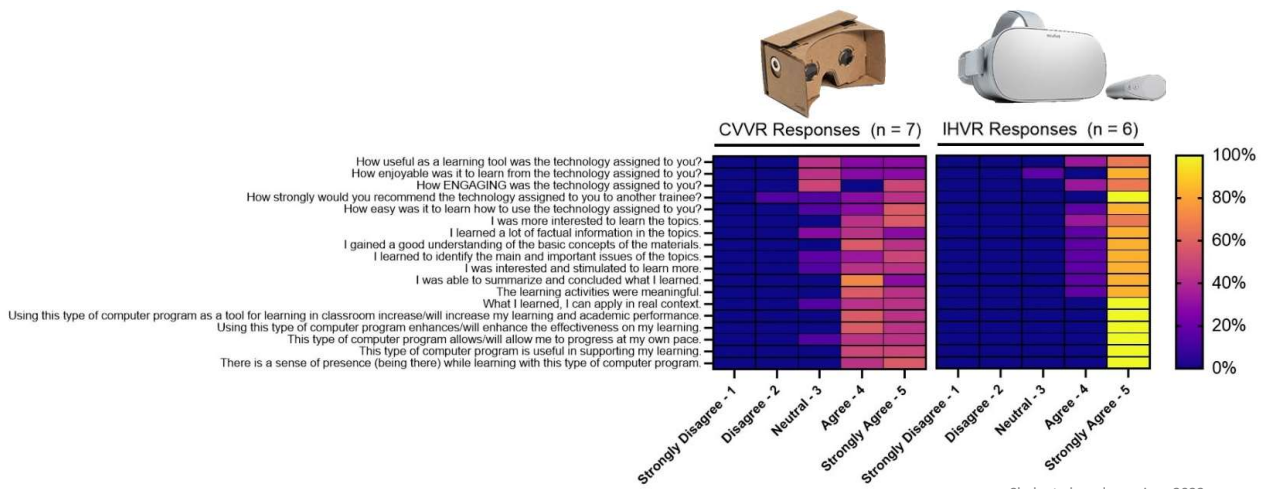


## Educational Outcome – Cardboard vs. Oculus



Shah et al, under review, 2022

## Educational Outcome – Cardboard vs. Oculus



Shah et al, under review, 2022



## Resident Comments on VR Brachytherapy Training

- ▶ Residents in both the CVVR and the IHVR groups felt their respective VR technology made them more interested to learn the topic.
- ▶ Residents felt that both technologies were successful in delivering factual information, improving understanding of basic concepts, helping identify the main/important issues of brachytherapy, and helping summarize material.
- ▶ Residents in groups felt that their VR technology stimulated them to learn more, increased their learning/academic performance, enhanced effectiveness of learning, allowed them to progress at their own pace, and supported their learning.
- ▶ Residents in both groups agree their respective VR technologies were meaningful in their learning. Moreover, residents believed what they learned from the VR technology could be applied in a real context.
- ▶ Both the CVVR and the IHVR created a sense of presence “being there” for the residents.

Shah et al, under review for Academic Medicine, 2022

## Summary

### Background

- Brachytherapy saves lives, yet under-utilized partially due to limited real-time OR teaching
- Immersive video-based training is a low cost & highly flexible alternative

### VR Video Technology

- Modest cost to produce with minimal impact in OR workflow
- Can be delivered using low to modest cost platform
- Portable, distributable, scalable

### VR Training Outcome

- Highly effective in improving confidence, subjective and objective technical skills
- Immersive, engaging, and enjoyable
- Low-cost cardboard is equally effective albeit less enjoyable

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