

**Student Choice Presentation:**  
***AirwayVR: Virtual Reality Trainer for Endotracheal Intubation***

**Introduction:**

**What is Endotracheal Intubation?**

It is a lifesaving procedure in which a tube is passed through the mouth into the trachea to maintain an open airway and facilitate artificial respiration.

- It is a complex skill.
- Requires significant training and experience to prevent complications.



*Figure 1: Endotracheal Intubation*

**Limitations without VR**

- Current methods of training, including manikins and cadaver, have limitations in terms of their availability for early medical professionals to learn and practice
- These training options also have limitations in terms of presenting high risk/difficult intubation cases for experts to mentally plan their approach in high-risk scenarios prior to the procedure.

**Methodology**

**Presented AirwayVR:**

Virtual reality-based simulation trainer for intubation training. Virtual reality technology offers high quality, low cost, and portable training solutions for medical practice training.

**Goal:**

To utilize a virtual reality platform for intubation skills training for target audiences (medical professionals) with two different objectives.

## **Target Audience:**

Medical students and residents

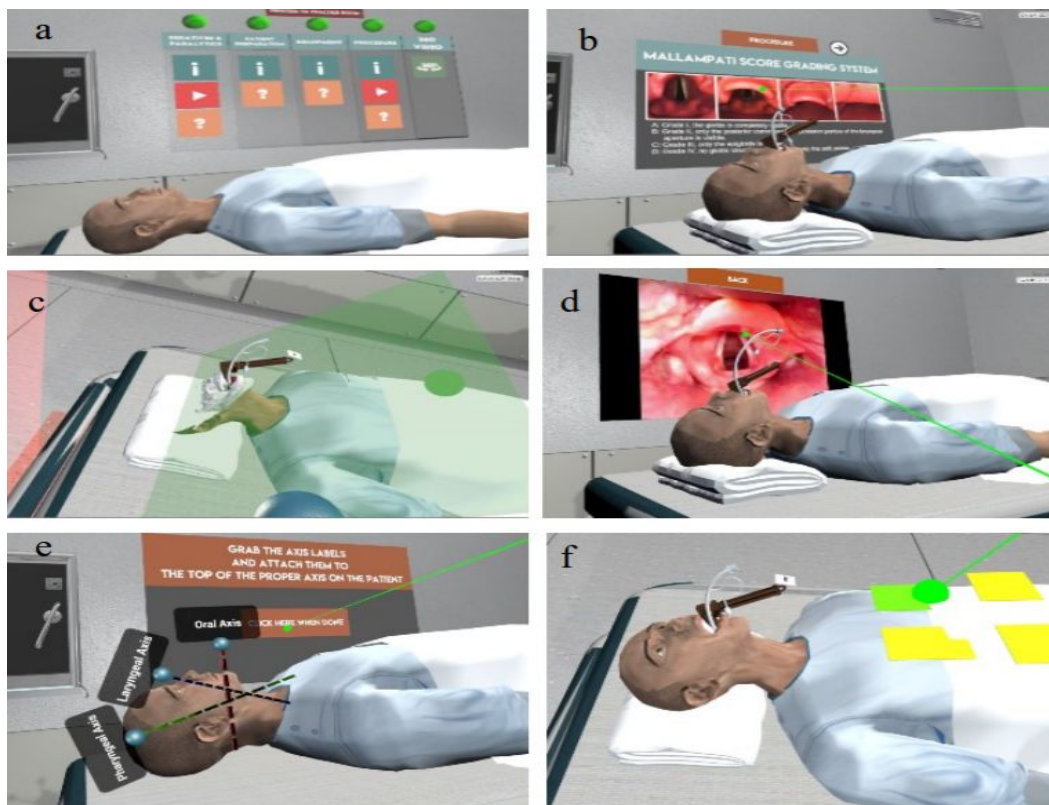
## **Objective:**

- To use AirwayVR as an introductory platform to learn and practice intubation in virtual reality for novice learners.
- To utilize this technology as a Just-in-time training platform for experts to mentally prepare for a complex case prior to the procedure.

## **AirwayVR Simulator**

- Developed by UnityTM
- Designed to run on any virtual reality headset that comes with the controllers (Oculus Rift and the HTC Vive)
- Users interact with the virtual environment by using controllers.
- Uses tools available to learn and practice.

## **VR Trainers for Novice learners**



*Figure 2: The first-person view of Airway VR learning space*

(a) shows learning modules and virtual patient;

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- (b) shows the inner view of laryngoscopy.
- (c) showcases the cutting plane
- (d) shows inside view of laryngoscopy.
- (e) shows 3 axes alignment during head positioning.
- (f) shows respiratory sound markers.

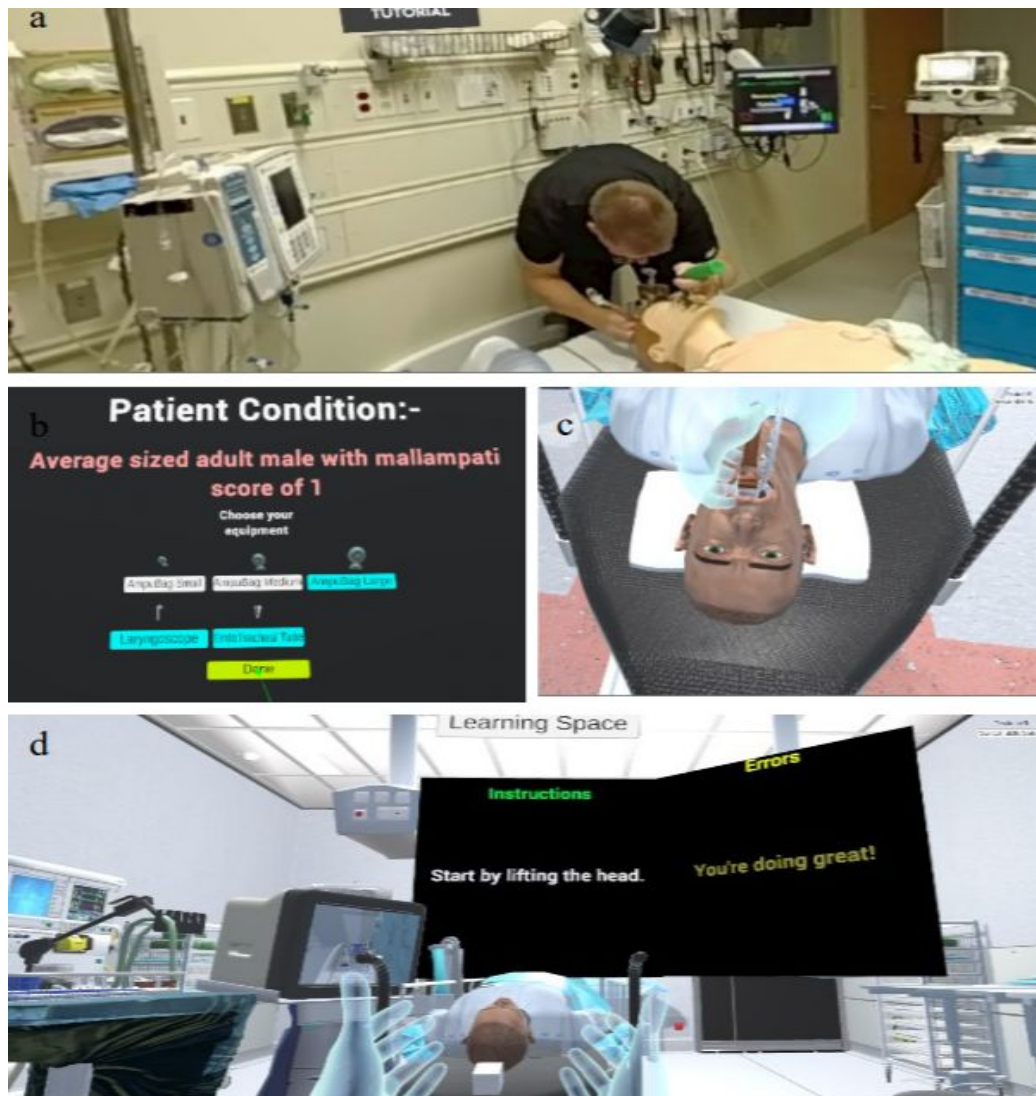


Figure 3: First-person view of AirwayVR practice space

- (a) shows the 360 degrees mixed reality environment;
- (b) showcases the equipment checkout scene;
- (c) shows the ETT insertion

(d) shows the practice OR environment

### **Just-in-time Training:**

- Used immediately before performing the procedure on an actual patient.
- Aimed at providing a quick refresher for experts to handle complex intubation scenarios.
- Recreated a 3D model from medical image data of a patient with a tumor near the vallecula (laryngoscope insertion point in the throat).
- This tumor creates an obstruction to laryngoscope insertion thus, complicating the intubation process. Users will be able to see the reconstructed 3D anatomy in the virtual patient and practice the laryngoscope insertion technique in a case-specific manner.

### **Demo:**

Demo 1 and demo 2

<https://uofi.app.box.com/s/l6u9vkvn0sst5kdff8vvs9ekw54cuj6m>

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### **Strength:**

- high quality,
- low cost,
- self-guided and
- supervised training environment for skills training in medicine.

### **Challenges**

- Identifying smaller goals and learning objectives of complete intubation procedure.
- Grouping small learning modules to form 10 -15 min interactive VR simulation tasks.
- Representation of human airway anatomy.
- Visual realism of 3D models from the segmentation of scan data.
- Visual markers in VR trainer for each learning goal.
- Providing feedback and assistance in the training process.
- Interaction in VR: Muscle memory is an important part of task training in medical education. Using VR interaction to teach medical equipment handling and developing muscle memory can be challenging.
- Develop assessments to measure the effectiveness of the self-guided curriculum.

**Future Work:**

- Intend to perform a study with medical students comparing their learning and intubation performance with and without immersive VR learning experience to study the efficacy of training in virtual reality.
- Collaboration between physicians and engineers to develop more modules and validate the trainer for content and construct.

**Conclusion:**

- Provide early exposure and training to medical professionals on medical procedures like intubation.
- Provide Just-in-time training for medical professionals to plan and practice high-risk low volume cases in intubation.