The CCM Airway Training Program will provide participants with the skill set to address pulmonary instability in the critically ill patient, through immediate application of techniques shown effective in difficult cases.

Participants will develop advanced skills with the bag valve mask to maximize oxygenation prior to intubation, to rescue after failed direct laryngoscopy, and to maintain prolonged mask ventilation if necessary.

Participants will develop advanced knowledge and skills in direct laryngoscopy to maximize the chance of successful endotracheal intubation during the first attempt, including optimal initial positioning of the patient, immediate use of bimanual laryngoscopy, directed assistance for lifting to avoid arm fatigue, and fine motor control of the epiglottis.

Participants will learn skills for managing factors that impair efforts at mask ventilation and direct laryngoscopy.

Participants will learn about ideal setup of equipment and patient positioning to successfully ventilate and intubate.

Participants will learn optimal means of communication with team members assisting with airway management.

**Specific Goals, and Testable Objectives:**

**BMV Goals:** The goal of bag-mask ventilation (BMV) training is a specific skill set designed to achieve a high level of oxygenation before intubation and to rescue from hypoxia if the first direct laryngoscopy (DL) is unsuccessful, and for prolonged BMV if that is the indicated course. Confounding factors such as heavy beard, overbite, missing teeth, dyspnea and regurgitation will be addressed.

**Testable Objectives for BMV:**

1. Establishes and reliably confirms effective seal (by rapid bag flip).
2. Able to overcome impediments to seal (sunken cheeks ("pop and pack"), edentulous (mouth open under mask), beard (surgical dressing).
3. Recognizes and effectively addresses leak
4. Repeatedly assesses airway patency by “feel of the bag” (confirmed by repeated induced obstruction.), and demonstrates ability to use this to synchronize ventilation.
5. Utilizes two-hand technique for bagging, and able to utilize two different two-hand techniques.
6. Ventilates effectively with minimal peak airway pressure, and maintains CPAP on bag during ventilation.
7. Demonstrates ability to synchronize support by eye.
8. Can describe, diagnose and describe resolution of four causes of decrease in effective compliance (airway obstruction, airway trapping, soft palate trapping, chest wall compliance).
9. Able to overcome obstruction to airflow (soft tissues/tongue, poor chest compliance) with use of head positioning, jaw thrust, head elevation, and/or oral airway.
10. Requires “informed” cricoid pressure from assistant during ventilation.

**DL Goals**: The goal of direct laryngoscopy (DL) and intubation training is the highest possible success on first pass, specifically including in the most difficult cases. In this training, the patient is presumed one of the unpredictable 50% of difficult intubations, who may require maximal support to obtain even minimal exposure. Even when glottal exposure proves less difficult the series of maneuvers is carried to optimal rather than merely adequate glottal exposure. In every case the trainee is to be prepared to incorporate each of the following.

1. **Avoidance of gross motor effort to retain fine motor control.** In a difficult intubation optimal exposure can require flexion of the upper thoracic as well as cervical spine, therefore gross motor effort can be required in small to average patients as well as the morbidly obese. Strong effort by the person intubating is not compatible with retention of the fine motor control that is required for careful manipulation of tissue, so the trainee is required to use supports for the head and shoulders and have an assistant do all the heavy lifting.

2. **Optimal initial positioning:** Preparation for maximal head elevation typically requires a shoulder roll because flexion of the upper thorax is often beyond the assistants’ ability, and head support as high as does not interfere with insertion of the blade. “Linen” blocks 2 and 4 inches high are available. MILS with assisted jaw thrust is considered optimal positioning for trauma patients.

3. **Prepared explicit instruction:** We require the fellow be prepared to give explicit instructions to their bystander/assistants, such as for head support: “If I release the laryngoscope and the head drops, that’s not enough support.”
4. Bimanual laryngoscopy: Laryngoscopy becomes bimanual as soon as the blade is deep enough that the right hand can release the patient’s lips, rather than as a secondary effort. Bimanual laryngoscopy is identical to external laryngeal manipulation (ELM) by the laryngoscopist (credit Levitan). Note that bimanual laryngoscopy has considerably greater benefit in novice laryngoscopy than is seen by more experienced operators; and the right hand is available because an assistant is required for head support. Bimanual laryngoscopy better informs the dynamic anatomy than exploration with only the blade; and use early in the lab imprints the value of the bimanual technique as a primary rather than secondary maneuver.

5. Optimal control of the epiglottis: The trainee is requested to invariably practice fine motor control by “flipping” the epiglottis with blade tip pressure against the hyoepiglottic ligament and/or with ELM. This is assured most effectively by monitoring the external screen of a Storz fiberoptic larscope while the trainee uses the blade for conventional DL. (Fellows who have required remediation typically had learned to insert the blade to a usually-appropriate depth and lift without first securing the epiglottis. The practice was efficient but resulted in disorientation when the glottis did not appear.)

6. Precise control of the endotracheal tube (ET). Details include securing the adaptor, clean technique, straight-to-cuff form, cuff deflated and air-filled syringe secured, minimal contact with teeth, maintaining glottal view, precise atraumatic insertion without poking, use of informed delicate maneuvers to overcome obstruction (such as hang-up on anterior laryngeal wall), insertion to proper depth, continuous secure grip on ET, cuff inflation by pressure monitor or minimum leak technique rather than volume.

7. Duration of laryngoscopy: Our concern for pulmonary instability limits laryngoscopy time to 30 seconds, with immediate withdrawal to resume CPAP recruitment. (The fellow can be encouraged to hold their own breath as an estimate.) However the priority is skillful integration of all the maneuvers likely to gain first-pass success. That skill set must be demonstrated before the 30-second limit is imposed.

Testable Behavioral Objectives in DL:

1. Knowledge and utilization of the appropriate tools for emergency intubation.
2. Prepares, inserts and safeguards the ET tube appropriately, with immediate confirmation of appropriate placement.
3. Specific advance instruction of the “unprepared” assistant for physical head/torso support, to avoid stress on the intubator’s left arm while establishing optimum laryngeal view.
4. Atraumatic insertion of the laryngoscope blade.
5. Demonstrates precise control of epiglottis, including use of pressure on mid-hyoepiglottic ligament ("sweet spot") to gain maximal lift of the epiglottis by both: 1. gentle blade manipulation without bimanual manipulation; 2. bimanual manipulation without blade movement.
6. Demonstrates bimanual manipulation of the larynx from the initial placement of the blade in the pharynx.
7. Routinely requests a volunteer/assistant at the bedside to augment the degree of cervical flexion as needed to in order to avoid any significant lifting by the operator’s left arm.
8. Demonstrate facility with lateral, retro-molar approach to the larynx with straight blade.

**Situation-dependent behavior:**
Scenarios will be presented during the airway management training, requiring consideration by the trainee for how best to adapt management, if required. During description of the scenario, active airway management should begin, just as in the clinical setting—there is no presumed “set up period,” but rather a patient in respiratory distress from the outset.
Scenario elements that might alter physician response include:
- history that reinforces the presumption of pulmonary instability: e.g., CHF, tachypnea, dyspnea, viral pneumonia, pulmonary edema, AMI, post-extubation stridor.
- history suggesting increased risk of passive or massive regurgitation: stomach blowing up when initial bagging is attempted, small bowel obstruction, hematemesis in liver failure patient, POD 1 after laparoscopic colectomy, evidence of emesis in airway.
- history suggesting possible acute increase in ICP: post-craniotomy for meningioma removal, large stroke two days ago, severe hyperglycemic who has been getting sleepier with treatment over several hours
- Cardiac arrest.
- Trauma with potential cervical spine injury.