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# Implementation of an Emergency Reflex Action Drill to Improve Perceived Knowledge and Confidence in Intubation Skills of Nurse Anesthesia Trainees

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**Implementation of an Emergency Reflex Action Drill to Improve Perceived Knowledge and**

**Confidence in Intubation Skills of Nurse Anesthesia Trainees**

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**Abstract**

Direct laryngoscopy remains the primary method for achieving intubation of the airway in general anesthesia. Novice laryngoscopists may encounter high stress and cognitive load when unexpectedly faced with a  Cormack-Lehane Grade III or IV view in an unfamiliar and time-pressured environment. An Emergency Reflex Action Drill (ERAD) is a specifically designed action sequence intended to execute clinical interventions with minimal cognitive load in the setting of marked time pressure. The purpose of this study was to examine the implementation of the ERAD "Head-Neck-Reset" to improve perceived knowledge and confidence in intubation skills of nurse anesthesia trainees. A convenience sample of 23 second year Nurse Anesthesia Trainees who had minimal training in direct laryngoscopy was utilized. Subjects completed a pre-survey, a short video-based educational intervention on the ERAD "Head-Neck-Reset", and a post-survey. Statistically significant improvement in perceived knowledge (1.72 points increase on a Likert scale) and confidence (1.68 points increase) was shown in the results of the postsurvey. Results of this pilot study suggest that additional research into this ERAD is merited to examine future applications in education of novice learners.

Keywords: video-based learning, laryngoscopy, mental practice, cognitive unloading.

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  Direct laryngoscopy is the primary method for achieving intubation of the airway in general anesthesia[1]. Direct laryngoscopy requires many encounters to achieve competence in this skill[1]. Across the disciplines, the "best look" laryngoscopy encompasses measures taken to optimize the view of the vocal cords.  This includes positioning the patient, positioning the laryngoscopist, and providing the pharmacologic adjuncts to relax the airway and patient[1]. Even with preparation, there is still the potential for a poor view of the vocal cords, increasing the level of difficulty of intubation.

  Difficulty in visualizing the glottis during direct laryngoscopy happens only 1.3% of every 100 intubation practices by anesthesia residents[2]. Yet respiratory events were implicated in 34% of all cases of death or brain damage in the American Society of Anesthesiology closed claims database as reported in 1990[2]. Schulte[3] found that novice anesthesia residents were more likely to fail at direct laryngoscopy when confronted with a grade III or IV view, and that number of failed attempts varied inversely with experience.

  Stein et al[1] found that out of four different laryngoscopy maneuvers, head elevation was most successful at improving glottic view in an anatomically normal airway. External laryngeal manipulation is a technique of pushing down on the neck at the thyroid cartilage to lower the vocal cords into view. This maneuver was found by Stein et al[1] to be the most successful in the anatomically difficult airway and Levitan et al[4] found that the maneuver can be successfully employed by novice laryngoscopists.

  In times of extreme stress, ability to problem solve new or unfamiliar situations is reduced. Developing mental frameworks for unanticipated crises is an important skill for the anesthesia provider. There are techniques that can be employed to manipulate the airway and improve the laryngeal view[1]. Although these methods and maneuvers have been researched and

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educated to novice laryngoscopists, there are few studies that identify a reflexive pattern or

approach when no cords are visible, also known as a Cormack-Lehane Grade 3 or 4 glottic

view[5].

**Study Goal**

The goal of this study was to evaluate the impact of an investigator-developed educational

video demonstrating "Head-Neck-Reset," on a nurse anesthesia trainee's perceived knowledge

and confidence for success when faced with a poor vocal cord view. This study also sought to

determine if an educational video demonstration of "Head-Neck-Reset" improve perceived

knowledge and confidence regarding intubating a patient with a poor glottic view among nurse

anesthesia trainees.

**Theoretical Framework**

A novice practitioner under stress demonstrates a decrease in information processing, as

well as working memory[6]. This can cause the novice to hesitate or become unable to think their

way out of the problem, causing a risk to the patient. A cognitive tool for dealing with stressful,

high stakes, and time-pressured situations in healthcare called Emergency Reflex Action Drill or

"ERAD" has been adapted from the military[6].

A comprehensive discussion of ERADs and the science behind them is detailed by Dr.

Michael Lauria[6]. Lauria describes the critical effects of stress response and how humans develop

abilities to respond to stress[6]. The goal of ERADs in medicine, per Dr. Lauria[6] is to incorporate

"specifically designed action sequences intended to execute clinical interventions with minimal

cognitive load in the setting of marked time pressure." Lauria explicates that the simplicity of

the ERAD can help the practitioner avoid time spent in decision-making or focusing on

ineffective options. When faced with a "specific cue" such as inability to visualize the glottis

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during laryngoscopy, a properly learned ERAD should reflexively trigger a correct sequence of mitigation actions in even a novice airway practitioner[6].

  The Head-Neck-Reset ERAD consists of three action sequences. "Head" refers to lifting the head physically off the bed to align the airway axes that allow line of sight to the vocal cords. "Neck" refers to external laryngeal manipulation or pushing down on the neck at the thyroid cartilage to drop the vocal cords into view. "Reset" refers to again providing manual respirations to oxygenate the patient, reassessing patient vital signs and positioning, and laryngoscopist positioning. Reset also includes considering changing operators or bringing a more advanced airway instrument such as videolaryngoscope or fiberoptic bronchoscope.

  Educational needs of airway learners can be met in a variety of ways, with interactive and high-fidelity experiences providing better value to the learner. One intervention that can be used to learn complex tasks is partial task training: breaking down a task into multiple components, looking for a rhythm to automate the pattern[2]. Partial task training can be accomplished via dual coding training theory[7]. This includes both written and visual interactive teaching to increase speed of comprehension and retention.

  Electronic devices and video-based education are tools educators can use to motivate learners[8]. Utilizing video-based education, Lee et al[8], employed this method to teach urinary catheterization. Prior to the simulation lab, the intervention group received a mobile-based video with the ability to review as many times as necessary. Ultimately, the research team found this modality increased participant confidence in learning a new clinical skill, and increased class satisfaction scores[8]. Utilizing multimedia tools can also promote student motivation and reinforce self-learning behaviors[7,8].

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## Methods

### Design

The study utilized a pretest posttest design to evaluate the change in nurse anesthesia trainees' perceived knowledge and confidence after viewing a video demonstrating the Head-Neck-Reset ERAD to improve glottic view when intubating a patient. The Head-Neck-Reset ERAD was developed using content from Lauria[6], Kovacs[9] and Weingart[10]. The pretest was administered immediately prior to the video and posttest immediately after the video. The posttest survey assessed  perceived knowledge and confidence after viewing the educational video.

### Sample and Setting

The study took place at Grainger Center for Simulation and Innovation within NorthShore University HealthSystem's Evanston Hospital on November 23rd and 24th, 2020. Inclusion criteria consisted of second year nurse anesthesia trainees who voluntarily participated.

### Instruments

A demographics survey was created to identify characteristics such as gender identity, age range, ethnicity, years of ICU experience.  An additional survey item asked about any previous education on evidence-based stepwise maneuvers to improve poor view of the vocal cords. Attached was a three-item pre-intervention survey and knowledge assessment survey related to the intervention. Two questions answered on a five-point Likert Scale, and the final question asked the respondent to list techniques from memory.

The post-intervention survey consisted of the same three questions as the presurvey, followed by three Likert scale questions about efficacy of the video-based intervention. A final

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Likert scale question gauged respondent interest in continuing to practice the ERAD to improve future laryngoscopy skill.

The intervention tool was a three-minute narrated video that laid out the foundation of the ERAD paradigm, followed by video demonstration of the Head-Neck-Reset ERAD, and a summary of the ERAD. The entire ERAD was described three times during the video to aid in retention. Video segments were recorded by the investigators in the Grainger Center for Simulation and Innovation at NorthShore University HealthSystem Evanston Hospital.

**Recruitment procedure**

Participants were recruited via email sent out to the entire cohort by the Committee chair, approximately one week prior to the intervention. In the email, the study objectives were explained. An explanation of their rights during participation was explained. Participation was voluntary with no monetary incentives or reimbursement.

**Data Collection**

Participants were given a demographics survey including questions on participant age, gender, ethnicity/race, type of nursing degree held (BSN or MSN), and years of intensive care unit experience. Due to the COVID-19 pandemic, surveys were developed on Qualtrics and generated with a QR code that participants were able to scan. Once the demographics and pretest survey were completed, the instructional video of Head-Neck-Reset was played. After the video, the posttest was immediately administered.

**Data Analysis**

Following data collection, pretest and posttest responses and the demographics surveys from the participants were entered into IBM Statistical Package for the Social Sciences (SPSS) software, Version 27.0. Using the software, a one sample t-test was performed to

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determine if there was a statistically significant improvement in participants' perceived

knowledge and confidence when faced with a poor glottic view. Descriptive statistical analyses

of the participants demographics were utilized to elucidate the characteristics of the sample.

## Results

A total of 24 nurse anesthesia trainees participated in the demographics survey (n=24), as

shown in Table 1. From this sample, the majority of the study participants identified as female

(n=19; 72.9%). Majority of participants were 30-39 years old (n=14; 59.3%), followed by 20-29

years old (n= 9; 37.5%), while the 40-49-year age group was significantly smaller (n=1; 4.2%).

Ethnically 83% (n=20) identify as White/NonHispanic, while 4.2% (n=1) as Hispanic/Latino,

8.3% (n=2) as Asian/Pacific Islander, and 4.2% (n=1) as Mixed Race. The majority of  subjects

had between 4 and 6 years of ICU experience (n=15, 62.5%), followed by 0-3 years of

experience (n= 4; 20.8%). The vast majority, (n=23; 95.83%) had never received formal

education on evidence-based stepwise maneuvers to improve vocal cord view.

For the subsequent surveys, there were 23 responses as one participant

excused themselves from participation. A one-sample t-test examined the statistical significance

between mean scores of the presurvey and postsurvey. On the pretest, subjects indicated a lower

level of perceived knowledge to implement an evidence-based technique to improve glottic view

when faced with a Cormack-Lehane Grade III or Grade IV view (M=2.61). Post intervention,

subjects recorded an increased level of perceived knowledge with a mean score M=4.39. The

difference in mean scores showed an increase of 1.78 points on a 5-point Likert scale, as shown

in Table 2.

Perceived confidence in ability to implement an evidence-based mitigation technique

when faced with a Cormack-Lehane Grade III or Grade IV view post intervention was improved

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in a statistically significant manner (p< 0.05, CI 95). Mean pretest scores were M=2.70. Postsurvey mean confidence score was M=4.43. The difference in mean scores showed an increase of 1.73 points on a 5-point Likert scale as shown in Table 3.

Participants were asked to list evidence-based techniques from their NorthShore didactic airway lecture that may improve a Cormack-Lehane Grade III or IV view. Answers included: "BURP maneuver," "repositioning head," "new blade," and "glidescope." Although most participants could name at least one maneuver (n=21), three chose not to answer, one stating "I can't remember." Following the intervention, all participants (n=23) were able to list at least three techniques.

## Discussion

The purpose of this study was to evaluate the impact of an investigator-developed educational video, demonstrating an emergency reflex action drill, Head-Neck-Reset, on a nurse anesthesia trainee's perceived knowledge and confidence for success when faced with a poor vocal cord view. Key findings showed improvement in overall knowledge and confidence as evidenced by improvement of mean scores. The greatest increase was in perceived knowledge with a difference of 1.72 points. There was a smaller change in perceived confidence, with a mean difference of 1.68 between presurvey and postsurvey scores.

During direct laryngoscopy, there are evidence-based maneuvers and techniques that can be employed to be most successful at improving glottic view in an anatomically normal airway. These methods have been researched extensively and are taught to novice laryngoscopists; however, there are few studies that identify a reflexive pattern or approach. Participants reported a higher perceived level of confidence in employing this pattern to improve their glottic view as evidenced in Table 4.

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An emergency reflex action drill, when properly learned, can be applied when faced with a specific cue, despite the presence of high stress and time pressure. For this project, the subject learned that when faced with a poor vocal cord view, the reflexive response should be "Head-Neck-Reset." This type of educational training broke down a complex action into a stepwise pattern. Following the intervention, the participants recorded greater knowledge and confidence in completing this task.

## Limitations

This study included an entire cohort of nurse anesthesia trainees, although limited to one nurse anesthesia program, decreasing the chance for external validity. The sample size is small, but it is varied among age and experience in intensive care nursing. The results showed a positive change in perceived knowledge and confidence among the group collectively. This suggests that similar results could be achieved for any nurse anesthesia trainee at the same point within their training.

At the time of this intervention, a small number of participants had begun an orientation week in the operating room. This included potential exposure to intubating human patients, as well as instruction from an anesthesia provider. When asked in the demographics survey, only one participant stated they had received formal education on stepwise maneuvers to improve poor view of the vocal cords.

Utilizing a presurvey and postsurvey design has the potential to threaten internal validity. However, the researchers assessed for change in perceived knowledge and confidence as recorded by the participant.  Due to the nature of the study design, it was completed in a short amount of time. The results were positive, but the emergency reflex action drill is a reflexive action developed over time with repeated practice.

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Further research is indicated to study the outcomes of the drill after multiple sessions of muscle memory training. The study has the potential to strengthen with additional periods of data collection, including mental rehearsals. Another opportunity of future study is to assess the implementation of this drill in the clinical setting and its impact on confidence and success in intubation in the nurse anesthesia trainee, especially when a poor glottic view is encountered.

**Conclusion**

The purpose of this project was to examine if an investigator-developed educational video demonstrating the ERAD "Head-Neck-Reset," improved perceived knowledge and confidence of nurse anesthesia trainees. Results provide preliminary evidence that exposure to a short video learning intervention for the ERAD provides a statistically significant difference in both perceived knowledge and confidence in novice laryngoscopists. While the results of a small, single center pilot trial utilizing a convenience sample are not generalizable, the promising results do provide a positive indicator for further research into applicability of the Head-Neck-Reset, and other potential ERADs, for educational training of nurse anesthesia trainees.

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| Table 1. Demographic characteristics of Study Participants | | | |
|---|---|---|---|
| | | **Frequency** | **Percentage** |
| **Gender Identity** | **Male** | 5 | 20.8 |
| | **Female** | 19 | 79.2 |
| **Age Group** | **20-29** | 9 | 37.5 |
| | **30-39** | 14 | 58.3 |
| | **40-49** | 1 | 4.2 |
| **Ethnicity** | **White/Nonhispanic** | 20 | 83.3 |
| | **Hispanic/Latino** | 1 | 4.2 |
| | **Asian/Pacific Islander** | 2 | 8.3 |
| | **Mixed Race** | 1 | 4.2 |
| **Years of ICU nursing experience** | **0-3** | 5 | 20.8 |
| | **4-6** | 15 | 62.5 |
| | **7-9** | 3 | 12.5 |
| | **10+** | 1 | 4.2 |
| **Previous Education on Maneuvers to Improve Poor Vocal Cord View** | **Yes** | 1 | 4.2 |
| | **No** | 23 | 95.8 |

**Table 2. Evaluation of Perceived Knowledge**

|  | N | Mean | t | df | Sig (2-tailed) |
|---|---|---|---|---|---|
| **Presurvey** | 23 | 2.61 | 13.296 | 22 | 0.000 |
| **Postsurvey** | 23 | 4.39 | 42.203 | 22 | 0.000 |

**Table 3. Evaluation of Perceived Confidence**

|  | N | Mean | t | df | Sig (2-tailed) |
|---|---|---|---|---|---|
| **Presurvey** | 23 | 2.70 | 15.725 | 22 | 0.000 |
| **Postsurvey** | 23 | 4.43 | 41.960 | 22 | 0.000 |

**Table 4. Evaluation of Head-Neck-Reset**

|  | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| Improved my confidence in reflexively implementing stepwise actions for improving poor view of the vocal cords during direct laryngoscopy | 23 | 1 | 5 | 4.3 | 0.876 |
| I plan to continue practicing this ERAD to maintain appropriate reflexive actions to improve my view during direct laryngoscopy when I cannot see the cords | 23 | 1 | 5 | 4.57 | 0.896 |