ASSIGNMENT 1: COMMUNICATING VALUE

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AI-Assisted Video Laryngoscope: Enhancing Intubation Success Rates

Problem Statement: A laryngoscope is a device used to perform a critical medical procedure known as intubation. It involves inserting a tube through the patient's mouth and into their airway to keep them breathing, especially during surgery or emergencies. The procedure, despite employing such specialized equipment, is confronted by two major challenges. Firstly, there is a low success rate of first-pass intubation. Recent studies have reported first-pass success rates of 74%-84% in the emergency department, indicating that repeated intubation attempts are often required.[1,2] Each unsuccessful try delays vital treatment and can lead to serious complications such as oxygen deprivation or injury to the throat and vocal cords.[3] Secondly, as the intubation success largely depends on the anesthesiologist's skill and experience[4], the shortage of anesthesiologists is a major concern. Canada's anesthesiology workforce is strained, with an anesthesia provider density of 12.42 per 100,000 population, which is lower than that of the U.S. (20.82), the U.K. (17.85), and Australia (23.09).[5] This shortage necessitates active planning and the training of mid-level providers within this specialty. These challenges underscore the urgent need for innovative solutions to improve intubation success rates and address the scarcity of specialists in this critical field.

Intervention Overview: To address intubation challenges, we propose the implementation of AI-assisted video laryngoscopes. This instrument integrates a high-resolution camera in the laryngoscope blade with an AI processor unit plus a display screen. The AI analyzes the video feed in real-time, accurately identifying and color-coding key anatomical structures like the glottis, epiglottis, and vocal cords. This information is overlaid on the display, providing real-time guidance throughout the intubation process. It can also alert providers to potential complications or difficult airway characteristics, significantly aiding in the visual identification of critical structures during the procedure.

The primary users of this intervention will include anaesthesiologists, emergency department physicians, and mid-level providers like nurse practitioners and physician assistants. Additionally, medical residents and fellows can use it as a training tool to improve their intubation skills and confidence.

The AI-assisted video laryngoscope will be implemented primarily in emergency departments, operating rooms, and intensive care units. Additionally, the technology will be integrated into medical training facilities to support the education of residents and fellows.

The AI-assisted video laryngoscope is at an advanced stage of research and development. The core technology - the AI-based Glottis Recognition Software - has been developed and rigorously tested in controlled settings.[6] Our proposal includes conducting clinical trials, analyzing results, and, if positive, adopting the technology. This approach balances innovation with patient safety and evidence-based practice.

Value Proposition: The AI-assisted video laryngoscope will increase first pass success rates[7], thereby shortening intubation time and minimizing number of complications which results in improving patient outcome. At the same time, it is especially applicable in emergency and ICU settings as it may reduce mortality rates thereby. Economically, it will reduce costs associated with failed attempts, extended procedures, and longer hospital stays.[8] Moreover, it will be particularly beneficial for less experienced practitioners in enhancing their skills and confidence considering that the device can achieve an accuracy of over 95% in identifying key anatomical structures.[6]

Considerations and Limitations: Even though there are various benefits associated with the AI-assisted video laryngoscope, it is essential to understand that there exist certain limitations and challenges. In order to ascertain its dependability, it is imperative that the precision of this AI system be highly validated with respect to diversity among patients' anatomies and symptoms displayed in numerous scenarios. There is a need to review the costs incurred when introducing this method, which include purchasing equipment for it and offering training to staff. Additionally, ethical and legal issues must be worked out with clarity for directives that provide a balance between AI assistance and human judgment. One of the big liability concerns when there are system errors will need to be addressed. All these factors have to be weighed and responded to if this technology is to see successful implementation and wide acceptance in clinical practice.

REFERENCES

1 Park L, Zeng I, Brainard A. Systematic review and meta-analysis of first-pass success rates in emergency department intubation: Creating a benchmark for emergency airway care. *Emerg Med Australas* 2017; **29**: 40–47.

2 Goto Y, Goto T, Hagiwara Y, Tsugawa Y, Watase H, Okamoto H *et al.* Techniques and outcomes of emergency airway management in Japan: An analysis of two multicentre prospective observational studies, 2010-2016. *Resuscitation* 2017; **114**: 14–20.

3 Maguire S, Schmitt PR, Sternlicht E, Kofron CM. Endotracheal intubation of difficult airways in emergency settings: A guide for innovators. *Med Devices* 2023; **16**: 183–199.

4 Raveendra U. Teaching and training in fibreoptic bronchoscope-guided endotracheal intubation. *Indian J Anaesth* 2011; **55**: 451–455.

5 Simkin S, Orser BA, Wilson CR, Bourgeault IL. The anesthesia workforce in Canada: a methodology to identify physician anesthesia providers using health administrative data. *Hum Resour Health* 2023; **21**: 34.

6 Masumori Y, Inoue S, Seino Y, Konishi M, Nishikawa H. Glottis recognition software development using artificial intelligence. *Cureus* 2024; **16**: e61464.

7 De Rosa S, Bignami E, Bellini V, Battaglini D. The future of artificial intelligence using images and clinical assessment for difficult airway management. *Anesth Analg* 2024; : 10.1213/ANE.0000000000006969.

8 Khanna NN, Maindarkar MA, Viswanathan V, Fernandes JFE, Paul S, Bhagawati M *et al.* Economics of artificial Intelligence in healthcare: Diagnosis vs. Treatment. *Healthcare (Basel)* 2022; **10**: 2493.