



## Topic Exploration Report

Topic explorations are designed to provide a high-level briefing on new topics submitted for consideration by Health Technology Wales. The main objectives of this report are to:

1. Determine the quantity and quality of evidence available for a technology of interest.
2. Identify any gaps in the evidence/ongoing evidence collection.
3. Inform decisions on topics that warrant fuller assessment by Health Technology Wales.

Topic:	Video laryngoscopes for use in pre-hospital care
Topic exploration report number:	TER288

### Introduction and aims

Health Technology Wales researchers searched for evidence on the use of video laryngoscopes to intubate patients in pre-hospital settings. We focussed on evidence that compared video laryngoscopy to direct laryngoscopy, but also included comparison to other interventions where this was available.

People receiving emergency care may require airway management by paramedics or other first responders prior to transfer to hospital, in cases such as out-of-hospital cardiac arrest, respiratory distress, coma or traumatic injuries. One option to manage the airway is endotracheal intubation: a flexible tube is placed into the trachea to maintain an open airway. Video laryngoscopes incorporate an integrated camera and display monitor. These devices provide indirect visualisation of the upper airway to help placement of a breathing tube.

### Summary of evidence

We identified 7 systematic reviews of video laryngoscopes, published between 2011 and 2019, but none of these focussed solely on the setting of interest (pre-hospital care). We also identified 3 randomised controlled trials (RCTs) specifically comparing video and direct laryngoscopy used by paramedics or in prehospital settings. We did not identify any previous health technology assessments or economic evaluations of video laryngoscopes in any patient group/setting.

#### *Evidence reviews*

We identified numerous systematic reviews of video laryngoscopes; here, we have focussed on those that compared the effectiveness of video laryngoscopy to direct laryngoscopy. Seven such reviews were identified, although none of these searched solely for evidence in pre-hospital settings: most included evidence from any setting; one review included evidence solely from intubations carried out on intensive care units. Four reviews included only RCTs;

the remainder included any trial design or did not specify trial designs included. One review specifically studied intubation in children.

All of the reviews reported success of intubation, in terms of number of attempts, success at first attempt or overall success. Two reviews (Hoshijima 2019; Lewis 2016) reported overall favourable outcomes with video laryngoscopy, but one review reported higher overall failure rates in children with video laryngoscopy compared to direct laryngoscopy (Sun 2014). The remaining four reviews did not find a significant difference in intubation success between video and direct laryngoscopy; however, two of these reviews carried out subgroup analysis by level of intubator experience and concluded that outcomes favoured video laryngoscopy where staff had less intubation experience.

Six reviews reported time required for intubation; again, findings were mixed: one review (Hoshijima 2019) found significantly shorter intubation times with video laryngoscopy; one review specifically studying evidence in children reported longer intubation times with video laryngoscopy compared to direct laryngoscopy (Sun 2014). The remaining reviews reported no significant differences in intubation times between the two approaches, but subgroup analyses in two reviews suggest intubation times may be better with video laryngoscopy when patients have a difficult airway (Su 2011) or intubation is carried out by non-experts (Griesdale 2012). Five reviews reported improved visualisation of the glottis with video laryngoscopy over direct laryngoscopy.

In two reviews reporting mortality (Lewis 2016, Huang 2017), no significant difference between video and direct laryngoscopy was found. Similarly, two reviews reported rates of complications (Huang 2017, Sun 2014) and found no significant difference between the interventions.

#### *Primary studies*

We identified three RCTs comparing video and direct laryngoscopy used in pre-hospital care deployed from ground or air ambulances. Two studies reported similar outcomes between video and direct laryngoscopy in terms of overall intubation success (Kreutziger 2019, Ducharme 2017) and first attempt success (Ducharme 2017), but the third study reported significantly poorer success rates with video than direct laryngoscopy (Trimmel 2016). Two studies reported better visualisation of the glottis with video laryngoscopy (Kreutziger 2019, Ducharme 2017); the third reported that impaired visualisation occurred in 17.3% of intubation attempts with video laryngoscopy but did not report rates of visualisation with the direct technique (Trimmel 2016). One study reported intubation times, number of attempts and difficulty (Kreutziger 2019) and did not find any significant difference between the two techniques for any of these outcomes.

### Areas of uncertainty

Manikin and cadaveric studies are a common method of measuring the effectiveness of laryngoscopy outcomes such as success/failure rates and time to intubation. It is unclear if there are some measurements where trials of this type offer advantages over measuring effectiveness in real clinical scenarios, bearing in mind the difficulties of carrying out an RCT in emergency care scenarios.

Evidence comparing video and direct laryngoscopy is available from a range of settings in addition to emergency care. It is unclear whether it is appropriate to extrapolate evidence of effectiveness from other settings, and if so, if there are some outcomes for which this is more appropriate than others.

We identified several different models of video laryngoscope reported in the published evidence. It is not clear if all these specific devices are relevant to clinical practice in Wales, or whether conclusions on the effectiveness of different individual devices can be drawn based on the available evidence.

## Conclusions

Video laryngoscopy has not been the subject of a recent health technology assessment by any other organisation. We identified numerous systematic reviews and controlled trials on this topic, the findings of which vary in terms of conclusions about the benefit of video laryngoscopes over direct laryngoscopes. This evidence also varied in terms of the population and setting considered. Three RCTs comparing video and direct laryngoscopes for intubation in specifically pre-hospital settings also draw mixed conclusions about the relative effectiveness of the two techniques. Further detailed evidence review would be required to determine the effectiveness of video laryngoscopy in the exact scenario of interest.

## Brief literature search results

Resource	Results
HTA organisations	
<a href="#">Healthcare Improvement Scotland</a>	We did not identify any relevant guidance or advice from this source.
<a href="#">Health Technology Assessment Group</a>	We did not identify any relevant guidance or advice from this source.
<a href="#">Health Information and Quality Authority</a>	We did not identify any relevant guidance or advice from this source.
<a href="#">EUnetHTA</a>	We did not identify any relevant guidance or advice from this source.
<a href="#">International HTA Database</a>	We identified one evidence review of potential relevance registered on this database, but this was published in 2004 and the original report could not be located. Other more recent sources are likely to be more relevant.
UK guidelines and guidance	
<a href="#">SIGN</a>	We did not identify any relevant guidance or advice from this source.
<a href="#">NICE</a>	Video laryngoscopes to help intubation in people with difficult airways. Medtech innovation briefing [MIB167]. Published: 19 December 2018. <a href="https://www.nice.org.uk/advice/mib167">https://www.nice.org.uk/advice/mib167</a>
Secondary literature and economic evaluations	
<a href="https://www.tripdatabase.com/">https://www.tripdatabase.com/</a>	<ul style="list-style-type: none"> <li>Griesdale DE, Liu D, McKinney J, et al. (2012). Glidescope® video-laryngoscopy versus direct laryngoscopy for endotracheal intubation: a systematic review and meta-analysis. <i>Can J Anaesth.</i> 59(1): 41-52. doi: 10.1007/s12630-011-9620-5</li> <li>Huang HB, Peng JM, Xu B, et al. (2017). Video Laryngoscopy for Endotracheal Intubation of Critically Ill Adults: A Systemic Review and Meta-Analysis. <i>Chest.</i> 152(3): 510-7. doi: 10.1016/j.chest.2017.06.012</li> <li>Sun Y, Lu Y, Huang Y, et al. (2014). Pediatric video laryngoscope versus direct laryngoscope: a meta-analysis of randomized controlled trials. <i>Paediatr Anaesth.</i> 24(10): 1056-65. doi: 10.1111/pan.12458</li> <li>Savino PB, Reichelderfer S, Mercer MP, et al. (2017). Direct Versus Video Laryngoscopy for Prehospital Intubation: A Systematic Review and Meta-analysis. <i>Acad Emerg Med.</i> 24(8): 1018-26. doi: 10.1111/acem.13193</li> </ul>
<a href="#">Cochrane library</a>	<ul style="list-style-type: none"> <li>Lewis SR, Butler AR, Parker J, et al. (2016). Videolaryngoscopy versus direct laryngoscopy for adult patients requiring tracheal intubation. <i>Cochrane Database Syst Rev.</i> 11(11): Cd011136. doi: 10.1002/14651858.CD011136.pub2</li> </ul>
<a href="#">Medline</a>	<ul style="list-style-type: none"> <li>Hoshijima H, Mihara T, Denawa Y, et al. (2019). Airtraq® is superior to the Macintosh laryngoscope for tracheal intubation: Systematic review with trial sequential analysis. <i>Am J Emerg Med.</i> 37(7): 1367-8. doi: 10.1016/j.ajem.2018.12.018</li> <li>Su YC, Chen CC, Lee YK, et al. (2011). Comparison of video laryngoscopes with direct laryngoscopy for tracheal intubation: a meta-analysis of randomised trials. <i>Eur J Anaesthesiol.</i> 28(11): 788-95. doi: 10.1097/EJA.0b013e32834a34f3</li> </ul>

Primary studies	
<a href="https://www.tripdatabase.com/">https://www.tripdatabase.com/</a>	We did not identify any additional studies from this source.
<a href="#">Medline</a>	<ul style="list-style-type: none"> <li>• Ducharme S, Kramer B, Gelbart D, et al. (2017). A pilot, prospective, randomized trial of video versus direct laryngoscopy for paramedic endotracheal intubation. Resuscitation. 114: 121-6. doi: 10.1016/j.resuscitation.2017.03.022</li> <li>• Kreutziger J, Hornung S, Harrer C, et al. (2019). Comparing the McGrath Mac Video Laryngoscope and Direct Laryngoscopy for Prehospital Emergency Intubation in Air Rescue Patients: A Multicenter, Randomized, Controlled Trial. Crit Care Med. 47(10): 1362-70. doi: 10.1097/ccm.0000000000003918</li> <li>• Ozgul U, Erdil FA, Erdogan MA, et al. (2019). Comparison of videolaryngoscope-guided versus standard digital insertion techniques of the ProSeal™ laryngeal mask airway: a prospective randomized study. BMC Anesthesiol. 19(1): 244. doi: 10.1186/s12871-019-0915-3</li> <li>• Trimmel H, Kreutziger J, Fitzka R, et al. (2016). Use of the GlideScope Ranger Video Laryngoscope for Emergency Intubation in the Prehospital Setting: A Randomized Control Trial. Crit Care Med. 44(7): e470-6. doi: 10.1097/ccm.0000000000001669</li> </ul>
Ongoing primary or secondary research	
<a href="#">PROSPERO database</a> <i>Check for recent systematic review protocols.</i>	Given the size of the existing evidence base, we did not search for ongoing secondary research.
<a href="#">Clinicaltrials.gov</a> <i>Only include if insufficient secondary evidence and primary studies found. Check for ongoing studies that have recently closed or are due to complete in the next 6-12 months.</i>	Given the size of the existing evidence base, we did not search for ongoing primary research.
Other	
Evidence provided by the topic proposer	<ul style="list-style-type: none"> <li>• Resuscitation Council UK. Adult advanced life support Guidelines. 2021. <a href="https://www.resus.org.uk/library/2021-resuscitation-guidelines/adult-advanced-life-support-guidelines">https://www.resus.org.uk/library/2021-resuscitation-guidelines/adult-advanced-life-support-guidelines</a></li> <li>• Bengier JR, Kirby K, Black S, et al. (2018). Effect of a Strategy of a Supraglottic Airway Device vs Tracheal Intubation During Out-of-Hospital Cardiac Arrest on Functional Outcome: The AIRWAYS-2 Randomized Clinical Trial. JAMA. 320(8): 779-91. doi: 10.1001/jama.2018.11597</li> <li>• Chiang WC, Hsieh MJ, Chu HL, et al. (2018). The Effect of Successful Intubation on Patient Outcomes After Out-of-Hospital Cardiac Arrest in Taipei. Ann Emerg Med. 71(3): 387-96.e2. doi: 10.1016/j.annemergmed.2017.08.008</li> <li>• Crewdson K, Lockey DJ, Røislien J, et al. (2017). The success of pre-hospital tracheal intubation by different pre-hospital providers: a systematic literature review and meta-analysis. Crit Care. 21(1): 31. doi: 10.1186/s13054-017-1603-7</li> <li>• Denninghoff KR, Nuño T, Pauls Q, et al. (2017). Prehospital Intubation is Associated with Favorable Outcomes and Lower Mortality in ProTECT III. Prehospital emergency care : official journal of the National Association of EMS Physicians and the National Association of State EMS Directors. 21(5): 539-44. doi: 10.1080/10903127.2017.1315201</li> </ul>

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- Fouche PF, Stein C, Simpson P, et al. (2017). Nonphysician Out-of-Hospital Rapid Sequence Intubation Success and Adverse Events: A Systematic Review and Meta-Analysis. *Ann Emerg Med*. 70(4): 449-59.e20. doi: 10.1016/j.annemergmed.2017.03.026
- Fouche PF, Stein C, Simpson P, et al. (2018). Flight Versus Ground Out-of-hospital Rapid Sequence Intubation Success: a Systematic Review and Meta-analysis. *Prehospital emergency care : official journal of the National Association of EMS Physicians and the National Association of State EMS Directors*. 22(5): 578-87. doi: 10.1080/10903127.2017.1423139
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- Hasegawa K, Hiraide A, Chang Y, et al. (2013). Association of Prehospital Advanced Airway Management With Neurologic Outcome and Survival in Patients With Out-of-Hospital Cardiac Arrest. *JAMA*. 309(3): 257-66. doi: 10.1001/jama.2012.187612
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- von Elm E, Schoettker P, Henzi I, et al. (2009). Pre-hospital tracheal intubation in patients with traumatic brain injury: systematic review of current evidence. *Br J Anaesth*. 103(3): 371-86. doi: 10.1093/bja/aep202
- Wang HE, Schmicker RH, Daya MR, et al. (2018). Effect of a Strategy of Initial Laryngeal Tube Insertion vs Endotracheal Intubation on 72-Hour Survival in Adults With Out-of-Hospital Cardiac Arrest: A Randomized Clinical Trial. *JAMA*. 320(8): 769-78. doi: 10.1001/jama.2018.7044

	<ul style="list-style-type: none"><li>Wang HE, Simeone SJ, Weaver MD, et al. (2009). Interruptions in cardiopulmonary resuscitation from paramedic endotracheal intubation. <i>Ann Emerg Med.</i> 54(5): 645-52.e1. doi: 10.1016/j.annemergmed.2009.05.024</li></ul>
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<b>Date of search:</b>	May 2021
<b>Concepts used:</b>	Video laryngoscopes (and synonyms)