Critical care – evidence and research

Introduction

Here you will find a summary of evidence and research relating to critical care and the role of speech and language therapy.

The role of SLTs working in critical care is still emerging in the UK, with reports of varied practices. Supporting evidence has been generated from other countries and it is important that UK clinicians develop robust research to identify best practice that is suitable for our model of care.

Visit the **RCSLT Research Centre** for information and resources to support your evidence-based practice, ways to enhance your continuing professional development (CPD), information about clinical academic careers, resources to help you get involved in research, and much more.

Please **contact us** if you have any suggestions or feedback on these pages.

Finding evidence

Access research articles through our **RCSLT Journals Collection** and more resources to support using evidence based practice in our **Research Centre**.

Many health and education organisations can provide access to journals via OpenAthens or Shibboleth.

You can also contact your local NHS library or **register directly**.

Systematic and Cochrane Reviews

These reviews may be helpful for SLTs working in critical care to provide data and research evidence to support their clinical involvement and influence decision-making.

Cochrane Reviews are systematic reviews of primary research in human health care and health policy, internationally recognised as the highest standard in evidence-based health care. **Search the Cochrane Database of Systematic Reviews.**

These can be used as a resource for journal club discussions and achieving team consensus. (Updated April 2019).

Blackwood, B., Burns, K. E., Cardwell, C. R., & O'Halloran, P. (2018). **Protocolized versus non-protocolized weaning for reducing the duration of mechanical ventilation in critically ill adult patients**. *Cochrane Database Syst Rev*(11), Cd006904. doi:10.1002/14651858.CD006904.pub3

Brass, P., Hellmich, M., Ladra, A., Ladra, J., & Wrzosek, A. (2018). **Percutaneous techniques versus surgical techniques for tracheostomy.** *Cochrane Database of Systematic Reviews*. doi:10.1002/14651858.cd008045.pub2

Brodsky, M. B., Levy, M. J., Jedlanek, E., Pandian, V., Blackford, B., Price, C., . . . Akst, L. M. (2018). **Laryngeal Injury and Upper Airway Symptoms After Oral Endotracheal Intubation With Mechanical Ventilation During Critical Care: A Systematic Review**. *Crit Care Med*, *46*(12), 2010-2017. doi:10.1097/ccm.0000000000003368

Brodsky, M. B., Suiter, D. M., González-Fernández, M., Michtalik, H. J., Frymark, T. B., Venediktov, R., & Schooling, T. (2016). **Screening Accuracy for Aspiration Using Bedside Water Swallow Tests: A Systematic Review and Meta-Analysis**. *Chest*, *150*(1), 148-163. doi:10.1016/j.chest.2016.03.059

Dowdy, D. W., Eid, M. P., Sedrakyan, A., Mendez-Tellez, P. A., Pronovost, P. J., & Herridge, M. S. (2005). **Quality of life in adult survivors of critical illness: a systematic review of the literature.** *Intensive Care Med*, 31. doi:10.1007/s00134-005-2592-6

Garrubba, M., Turner, T., & Grieveson, C. (2009). **Multidisciplinary care for tracheostomy patients: a systematic review**. *Crit Care*, 13(6), R177. doi:10.1186/cc8159

Goff, D., & Patterson, J. (2020). **Eating and drinking with an inflated tracheostomy cuff: a systematic review of the aspiration risk**. *International Journal of Language & Communication Disorders*, 54(1), 30-40. doi:10.1111/1460-6984.12430

Hua, F., Xie, H., Worthington, H. V., Furness, S., Zhang, Q., & Li, C. (2020). **Oral hygiene care for critically ill patients to prevent ventilator-associated pneumonia**. *Cochrane Database of*

Systematic Reviews. doi:10.1002/14651858.cd008367.pub3

Joffe, A., Anton, N., Lequier, L., Vandermeer, B., Tjosvold, L., Larsen, B., & Hartling, L. (2016). **Nutritional support for critically ill children**. *Cochrane Database Syst Rev*(5), Cd005144. doi:10.1002/14651858.CD005144.pub3

Jordan, J., Rose, L., Dainty, K. N., Noyes, J., & Blackwood, B. (2016). **Factors that impact on the use of mechanical ventilation weaning protocols in critically ill adults and children: a qualitative evidence-synthesis (PDF)**. *Cochrane Database of Systematic Reviews.* doi:10.1002/14651858.cd011812.pub2

Liu, B., Li, S. Q., Zhang, S. M., Xu, P., Zhang, X., Zhang, Y. H., . . . Zhang, W. H. (2013). **Risk factors of ventilator-associated pneumonia in pediatric intensive care unit: a systematic review and meta-analysis**. *Journal of Thoracic Disease*, 5(4), 525-531. doi:10.3978/j.issn.2072-1439.2013.08.31

Liu, C. C., Livingstone, D., Dixon, E., & Dort, J. C. (2018). **Early versus late tracheostomy: a systematic review and meta-analysis**. *Otolaryngol Head Neck Surg*, 152(2), 219-227. doi:10.1177/0194599814561606

Moodie, L., Reeve, J., & Elkins, M. (2011). **Inspiratory muscle training increases inspiratory muscle strength in patients weaning from mechanical ventilation: a systematic review**. *Journal of Physiotherapy*, 57(4), 213-221. doi:10.1016/s1836-9553(11)70051-0

O'Connor, L. R., Morris, N. R., & Paratz, J. (2018). **Physiological and clinical outcomes associated with use of one-way speaking valves on tracheostomised patients: A systematic review.** *Heart & Lung*. doi:10.1016/j.hrtlng.2018.11.006

Rennick, J. E., & Rashotte, J. (2009). **Psychological outcomes in children following pediatric intensive care unit hospitalization: a systematic review of the research**. *J Child Health Care*, 13(2), 128-149. doi:10.1177/1367493509102472

Rose, L., Adhikari, N. K., Leasa, D., Fergusson, D. A., & McKim, D. (2016). **Cough augmentation techniques for extubation or weaning critically ill patients from mechanical ventilation**. *Cochrane Database of Systematic Reviews*. doi:10.1002/14651858.cd011833.pub2

Shudy, M., De Almeida, M. L., Ly, S., Landon, C., Groft, S., Jenkins, T. L., & Nicholson, C. E. (2006). **Impact of Pediatric Critical Illness and Injury on Families: A Systematic Literature Review**. *118* (Supplement_3), S203-S218. doi:10.1542/peds.2006-0951b

Siempos, I. I., Ntaidou, T. K., Filippidis, F. T., & Choi, A. M. K. (2015). **Effect of early versus late or no tracheostomy on mortality and pneumonia of critically ill patients receiving mechanical ventilation: a systematic review and meta-analysis**. *The Lancet Respiratory Medicine*, *3(2)*, 150-

158. doi:https://doi.org/10.1016/S2213-2600(15)00007-7

Skoretz, S. A., Flowers, H. L., & Martino, R. (2010). **The incidence of dysphagia following endotracheal intubation: a systematic review**. *Chest, 137*. doi:10.1378/chest.09-1823

Speed, L., & Harding, K. E. (2013). **Tracheostomy teams reduce total tracheostomy time and increase speaking valve use: a systematic review and meta-analysis**. *J Crit Care, 28*(2), 216 e211-210. doi:10.1016/j.jcrc.2012.05.005

ten Hoorn, S., Elbers, P. W., Girbes, A. R., & Tuinman, P. R. (2016). **Communicating with conscious and mechanically ventilated critically ill patients: a systematic review.** *Critical Care*, 20(1), 333. doi:10.1186/s13054-016-1483-2

Ullman, A. J., Aitken, L. M., Rattray, J., Kenardy, J., Le Brocque, R., Macgillivray, S., & Hull, A. M. (2014). **Diaries for recovery from critical illness**. Cochrane Database of Systematic Reviews. doi:10.1002/14651858.cd010468.pub2

Journal articles

This is a selection of journal articles to support SLT practice in critical care, grouped within a range of impairments. Please note this list is not exhaustive. (Updated April 2019)

Tracheostomy

Amathieu, R., Sauvat, S., Reynaud, P., Slavov, V., Luis, D., Dinca, A., . . . Dhonneur, G. (2012). **Influence of the cuff pressure on the swallowing reflex in tracheostomized intensive care unit patients.** ***British Journal of Anaesthesia***, *109*(4), 578-583. doi:10.1093/bja/aes210

Calamai, I., Giuntini, R., Tomeo, F., & Spina, R. (2018). **Sudden appearance of neck and face emphysema during above cuff vocalisation.** ***Intensive Care Med***, 44(11), 1951-1952. doi:10.1007/s00134-018-5233-6

Dziewas, R., Stellato, R., van der Tweel, I., Walther, E., Werner, C. J., Braun, T., . . . Pfausler, B. (2018). **Pharyngeal electrical stimulation for early decannulation in tracheotomised patients with neurogenic dysphagia after stroke (PHAST-TRAC): a prospective, single-blinded, randomised trial**. *The Lancet Neurology*, 17(10), 849-859. doi:10.1016/S1474-4422(18)30255-2

Kothari, M., Bjerrum, K., Nielsen, L. H., Jensen, J., & Nielsen, J. F. (2017). **Influence of External Subglottic Air Flow on Dysphagic Tracheotomized Patients With Severe Brain Injury**. *Ann Otol Rhinol Laryngol*, 126(3), 199-204. doi:10.1177/0003489416683192

Leder, S. B., & Ross, D. A. (2010). **Confirmation of No Causal Relationship Between Tracheotomy and Aspiration Status: A Direct Replication Study**. *Dysphagia*, 25(1), 35-39. doi:10.1007/s00455-009-9226-z

Ledgerwood, L. G., Salgado, M. D., Black, H., Yoneda, K., Sievers, A., & Belafsky, P. C. (2013). **Tracheostomy tubes with suction above the cuff reduce the rate of ventilator-associated pneumonia in intensive care unit patients**. *Ann Otol Rhinol Laryngol*, 122(1), 3-8. doi:10.1177/000348941312200102

McGrath, B. A., Wallace, S., Wilson, M., Nicholson, L., Felton, T., Bowyer, C., & Bentley, A. M. (2018). **Safety and feasibility of above cuff vocalisation for ventilator-dependant patients with tracheostomies**. *Journal of the Intensive Care Society*, 0(0), 1751143718767055. doi:10.1177/1751143718767055

Wilkinson, K. A., Freeth, H., & Martin, I. C. (2015). **Are we 'on the right trach?' The National Confidential Enquiry into Patient Outcome and Death examines tracheostomy care**. *Journal of Laryngology and Otology*, 129(3), 212-216. doi:10.1017/s0022215115000158

Dysphagia/Swallowing

Barker, J., Martino, R., Reichardt, B., Hickey, E. J., & Ralph-Edwards, A. (2009). **Incidence and impact of dysphagia in patients receiving prolonged endotracheal intubation after cardiac surgery**. *Can J Surg*, 52.

Brodsky, M. B., De, I., Chilukuri, K., Huang, M., Palmer, J. B., & Needham, D. M. (2018). **Coordination of Pharyngeal and Laryngeal Swallowing Events During Single Liquid Swallows After Oral Endotracheal Intubation for Patients with Acute Respiratory Distress Syndrome.** *Dysphagia*, 33(6), 768-777. doi:10.1007/s00455-018-9901-z

Brodsky, M. B., Gellar, J. E., Dinglas, V. D., Colantuoni, E., Mendez-Tellez, P. A., Shanholtz, C., . . . Needham, D. M. (2014). **Duration of oral endotracheal intubation is associated with dysphagia symptoms in acute lung injury patients**. *Journal of Critical Care*, 29(4), 574-579. doi: **http://dx.doi.org/10.1016/j.jcrc.2014.02.015**

Brodsky, M. B., Huang, M., Shanholtz, C., Mendez-Tellez, P. A., Palmer, J. B., Colantuoni, E., & Needham, D. M. (2016). **Recovery of Dysphagia Symptoms after Oral Endotracheal Intubation in ARDS Survivors: A 5- Year Longitudinal Study**. *Ann Am Thorac Soc*. doi:10.1513/AnnalsATS.201606-455OC

Brodsky, M. B., Levy, M. J., Jedlanek, E., Pandian, V., Blackford, B., Price, C., . . . Akst, L. M. (2018). **Laryngeal Injury and Upper Airway Symptoms After Oral Endotracheal Intubation With Mechanical Ventilation During Critical Care: A Systematic Review**. *Crit Care Med*, 46(12), 2010-2017. doi:10.1097/ccm.0000000000003368

Christensen, M., & Trapl, M. (2017). **Development of a modified swallowing screening tool to manage post-extubation dysphagia.** ***Nursing in Critical Care***, 23(2), 102-107. doi:doi:10.1111/nicc.12333

Ding, R., & Logemann, J. A. (2005). **Swallow physiology in patients with trach cuff inflated or deflated: a retrospective study**. *Head Neck*, *27*(9), 809-813. doi:10.1002/hed.20248

Elpern, E. H., Scott, M. G., Petro, L., & Ries, M. H. (1994). **Pulmonary aspiration in mechanically ventilated patients with tracheostomies**. *Chest*, *105*(2), 563-566.

Hafner, G., Neuhuber, A., Hirtenfelder, S., Schmedler, B., & Eckel, H. E. (2007). **Fiberoptic endoscopic evaluation of swallowing in intensive care unit patients**. *Eur Arch Otorhinolaryngol*, 265(4), 441-446. doi:10.1007/s00405-007-0507-6

Hales, P. A., Drinnan, M. J., & Wilson, J. A. (2008). **The added value of fibreoptic endoscopic evaluation of swallowing in tracheostomy weaning**. *Clinical Otolaryngology*, *33*, 319-324.

Kjeldsen, C. L., Hansen, M. S., Jensen, K., Holm, A., Haahr, A., & Dreyer, P. (2018). Patients' experience of thirst while being conscious and mechanically ventilated in the intensive care unit. *Nurs Crit Care*, 23(2), 75-81. doi:10.1111/nicc.12277

Leder, S. B., Cohn, S. M., & Moller, B. A. (1998). **Fiberoptic Endoscopic Documentation of the High Incidence of Aspiration following Extubation in Critically Ill Trauma Patients.** *Dysphagia, 13*, 208–212.

Leder, S. B., & Ross, D. A. (2000). **Investigation of the causal relationship between tracheotomy and aspiration in the acute care setting.** *Laryngoscope*, *110*(4), 641-644. doi:10.1097/00005537-200004000-00019

Leder, S. B., Suiter, D. M., Warner, H. L., & Kaplan, L. J. (2011). **Initiating safe oral feeding in critically ill intensive care and step-down unit patients based on passing a 3-ounce (90 milliliters) water swallow challenge**. *J Trauma*, 70(5), 1203-1207. doi:10.1097/TA.0b013e3181fc607a

Macht, M., King, C. J., Wimbish, T., Clark, B. J., Benson, A. B., Burnham, E. L., . . . Moss, M. (2013). **Post-extubation dysphagia is associated with longer hospitalization in survivors of critical illness with neurologic impairment**. *Crit Care.*, 17(3), R119.

Marvin, S., Thibeault, S., & Ehlenbach, W. J. (2019). **Post-extubation Dysphagia: Does Timing of Evaluation Matter?** *Dysphagia*, 34(2), 210-219. doi:10.1007/s00455-018-9926-3

Miles, A., McLellan, N., Machan, R., Vokes, D., Hunting, A., McFarlane, M., . . . Lynn, K. (2018). **Dysphagia and laryngeal pathology in post-surgical cardiothoracic patients**. *Journal of Critical Care*, 45, 121-127. doi: **https://doi.org/10.1016/j.jcrc.2018.01.027**

Perren, A., Zürcher, P., & Schefold, J. C. (2019). **Clinical Approaches to Assess Post-extubation Dysphagia (PED) in the Critically Ill**. *Dysphagia*. doi:10.1007/s00455-019-09977-w

Ponfick, M., Linden, R., & Nowak, D. A. (2015). **Dysphagia—A Common, Transient Symptom in Critical Illness Polyneuropathy: A Fiberoptic Endoscopic Evaluation of Swallowing Study**. *Critical Care Medicine*, 43, 365–372.

Pryor, L., Ward, E., Cornwell, P., O'Connor, S., & Chapman, M. (2016). **Patterns of return to oral intake and decannulation post-tracheostomy across clinical populations in an acute inpatient setting**. *Int J Lang Commun Disord*, 51(5), 556-567. doi:10.1111/1460-6984.12231

Scheel, R., Pisegna, J. M., McNally, E., Noordzij, J. P., & Langmore, S. E. (2015). **Endoscopic Assessment of Swallowing After Prolonged Intubation in the ICU Setting**. *Ann Otol Rhinol Laryngol*, 125(1), 43-52. doi:10.1177/0003489415596755

Skoretz, S. A., Yau, T. M., Ivanov, J., Granton, J. T., & Martino, R. (2014). **Dysphagia and associated risk factors following extubation in cardiovascular surgical patients**. *Dysphagia*, 29. doi:10.1007/s00455-014-9555-4

Solh, A., Okada, M., Bhat, A., & Pietrantoni, C. (2003). **Swallowing disorders post orotracheal intubation in the elderly**. *Intensive Care Med*, 29. doi:10.1007/s00134-003-1870-4

Tolep, K. (1996). Swallowing Dysfunction in Patients Receiving Prolonged Mechanical Ventilation. *CHEST Journal*, 109(1), 167. doi:10.1378/chest.109.1.167

Communication/Voice/speech

Egbers, P. H., Bultsma, R., Middelkamp, H., & Boerma, E. C. (2014). **Enabling speech in ICU patients during mechanical ventilation**. *Intensive Care Med*, 40(7), 1057-1058. doi:10.1007/s00134-014-3315-7

Freeman-Sanderson, A., Togher, L., Kenny, B., Elkins, M., & Phipps, P. (2016). **Loss of voice in mechanically ventilated tracheostomy patients: The patient experience in ICU**. *Australian Critical Care*, 29(2), 115. doi:10.1016/j.aucc.2015.12.013

Freeman-Sanderson, A. L., Togher, L., Elkins, M. R., & Phipps, P. R. (2016). **Return of Voice for Ventilated Tracheostomy Patients in ICU: A Randomized Controlled Trial of Early-Targeted Intervention**. *Crit Care Med*, 44(6), 1075-1081. doi:10.1097/ccm.0000000000001610

Khalaila, R., Zbidat, W., Anwar, K., Bayya, A., Linton, D. M., & Sviri, S. (2011). **Communication Difficulties and Psychoemotional Distress in Patients Receiving Mechanical Ventilation**. 20(6), 470-479. doi:10.4037/ajcc2011989

Pandian, V., Thompson, C. B., Feller-Kopman, D. J., & Mirski, M. A. (2015). **Development and Validation of a Quality-of-Life Questionnaire for Mechanically Ventilated ICU Patients**. *Critical Care Medicine*, *43*(1), 142-148. doi:10.1097/ccm.0000000000000552

Patak, L., Gawlinski, A., Fung, N. I., Doering, L., Berg, J., & Henneman, E. A. (2006). **Communication boards in critical care: patients' views**. *Appl Nurs Res*, 19(4), 182-190. doi:10.1016/j.apnr.2005.09.006

Rose, L., Istanboulian, L., Smith, O. M., Silencieux, S., Cuthbertson, B. H., Amaral, A. C. K., . . . Dale, C. (2018). **Feasibility of the electrolarynx for enabling communication in the chronically critically**

ill: The EECCHO study. *J Crit Care*, *47*, 109-113. doi:10.1016/j.jcrc.2018.06.013

Sutt, A. L., & Fraser, J. F. (2015). **Speaking valves as part of standard care with tracheostomized mechanically ventilated patients in intensive care unit**. *J Crit Care*, 30(5), 1119-1120. doi:10.1016/j.jcrc.2015.06.015

Wallace, S. McGowan, S., Sutt, A. (2022). **Benefits and options for voice restoration in mechanically ventilated intensive care unit patients with a tracheostomy**. *Journal of the Intensive Care Society.* doi: **10.1177/17511437221113162**.

Teams

Bonvento, B., Wallace, S., Lynch, J., Coe, B., & McGrath, B. A. (2017). **Role of the MDT in the care of the tracheostomy patients**. *Journal of Multidisciplinary Healthcare*, 11(10), 391-398. doi:10.2147/JMDH.S118419

Cameron, T. S., McKinstry, A., Burt, S. K., Howard, M. E., Bellomo, R., Brown, D. J., . . . O'Donoghue, F. J. (2009). **Outcomes of patients with spinal cord injury before and after introduction of an interdisciplinary tracheostomy team**. *Crit Care Resusc*, *11*(1), 14-19.

Frank, U., Maeder, M., & Sticher, H. (2007). Dysphagic patients with tracheostomies: **A multidisciplinary approach to treatment and decannulation management**. *Dysphagia*, 22(1), 20-29. doi:10.1007/s00455-006-9036-5

McRae, J. (2018). The role of speech and language therapy in critical care. *ICU Management & Practice* , *18*(2), 128-131.

Mitchell, R., Parker, V., & Giles, M. (2013). **An interprofessional team approach to tracheostomy care: A mixed-method investigation into the mechanisms explaining tracheostomy team effectiveness**. *International Journal of Nursing Studies*, *50*(4), 536-542.

Paediatrics

Audag, N., Goubau, C., Toussaint, M., & Reychler, G. (2017). **Screening and evaluation tools of dysphagia in children with neuromuscular diseases: a systematic review**. *Developmental Medicine and Child Neurology*, *59*(6), 591-596. doi:10.1111/dmcn.13354

Costello, J. M., Patak, L., & Pritchard, J. (2010). **Communication vulnerable patients in the pediatric ICU: Enhancing care through augmentative and alternative communication**. *Journal of Pediatric Rehabilitation Medicine*, *3*(4), 289-301. doi:10.3233/prm-2010-0140

da Silva, P. S. L., Lobrigate, N. L., & Fonseca, M. C. M. (2018). **Postextubation Dysphagia in Children: The Role of Speech-Language Pathologists.** *Pediatric Critical Care Medicine*, *19*(10), e538-e546. doi:10.1097/pcc.0000000000001688

Kohr, L. M., Dargan, M., Hague, A., Nelson, S. P., Duffy, E., Backer, C. L., & Mavroudis, C. (2003). T**he incidence of dysphagia in pediatric patients after open heart procedures with transesophageal echocardiography**. *Ann Thorac Surg*, 76(5), 1450-1456.

Lee, J. H., Rehder, K. J., Williford, L., Cheifetz, I. M., & Turner, D. A. (2013). **Use of high flow nasal cannula in critically ill infants, children, and adults: a critical review of the literature**. 39(2), 247-257. doi:10.1007/s00134-012-2743-5

Morrow, B. M., & Norman, V. (2018). **Food for Thought-Pediatric Critical Illness and Feeding Outcomes**. *Pediatric Critical Care Medicine*, 19(10), 1011-1012. doi:10.1097/pcc.0000000000001690

Traube, C., Silver, G., Gerber, L. M., Kaur, S., Mauer, E. A., Kerson, A., . . . Greenwald, B. M. (2017). **Delirium and Mortality in Critically Ill Children: Epidemiology and Outcomes of Pediatric Delirium**. *Crit Care Med*, 45(5), 891-898. doi:10.1097/ccm.0000000000002324

Research impact case studies

The ‘Improving Tracheostomy Care’ group is part of the Global Tracheostomy Collaborative and has been focused on changing practice across the UK. They reported their **interim results at the end of 2018**.

Research priorities

The RCSLT, in collaboration with the **National Institute of Health Research (NIHR)** is working on a project to determine the top priorities for new research in speech and language therapy. Read about the **RCSLT's research priorities**, including **dysphagia research priorities for adults**, paediatrics and non-age specific, some of which may be relevant to the critical care population.

Reay, H., Arulkumaran, N. & Brett, S. J. (2014). **Priorities for Future Intensive Care Research in the UK: Results of a James Lind Alliance Priority Setting Partnership**. Journal of Intensive Care Society, 15 (4), 288-296.

Critical Care is one of the NIHR speciality research areas, further details of projects can be found **on the NIHR website**.