AJSLP

Tutorial

Speech-Language Pathology Guidance for Tracheostomy During the COVID-19 Pandemic: An International Multidisciplinary Perspective

Charissa J. Zaga,[a,b,c] Vinciya Pandian,[d,e] Martin B. Brodsky,[e,f,g] Sarah Wallace,[h] Tanis S. Cameron,[c] Caroline Chao,[c,i] Lisa Ann Orloff,[j] Naomi E. Atkins,[k] Brendan A. McGrath,[l] Cathy L. Lazarus,[m] Adam P. Vogel,[b,n,o] and Michael J. Brenner[p]

Purpose: As the COVID-19 pandemic has unfolded, there has been growing recognition of risks to frontline health care workers. When caring for patients with tracheostomy, speech-language pathologists have significant exposure to mucosal surfaces, secretions, and aerosols that may harbor the SARS-CoV-2 virus. This tutorial provides guidance on practices for safely performing patient evaluation and procedures, thereby reducing risk of infection.
Method: Data were collated through review of literature, guidelines, and consensus statements relating to COVID-19 and similar high-consequent infections, with a focus on mitigating risk of transmission to health care workers. Particular emphasis was placed on speech-language pathologists, nurses, and other allied health professionals. A multinational interdisciplinary team then analyzed findings, arriving at recommendations through consensus via electronic communications and video conference.
Results: Reports of transmission of infection to health care workers in the current COVID-19 pandemic and previous outbreaks substantiate the need for safe practices. Many procedures routinely performed by speech-language pathologists have a significant risk of infection due to aerosol generation. COVID-19 testing can inform level of protective equipment, and meticulous hygiene can stem spread of nosocomial infection. Modifications to standard clinical practice in tracheostomy are often required. Personal protective equipment, including either powered air-purifying respirator or N95 mask, gloves, goggles, and gown, are needed when performing aerosol-generating procedures in patients with known or suspected COVID-19 infection.
Conclusions: Speech-language pathologists are often called on to assist in the care of patients with tracheostomy and known or suspected COVID-19 infection. Appropriate care of these patients is predicated on maintaining the health and safety of the health care team. Careful adherence to best practices can significantly reduce risk of infectious transmission.

[a]Department of Speech Pathology, Austin Health, Melbourne, Victoria, Australia
[b]Centre for Neuroscience of Speech, University of Melbourne, Victoria, Australia
[c]Tracheostomy Review and Management Service, Austin Health, Melbourne, Victoria, Australia
[d]Department of Nursing Faculty, Johns Hopkins University, Baltimore, MD
[e]Outcomes After Critical Illness and Surgery (OACIS) Research Group, Johns Hopkins University, Baltimore, MD
[f]Department of Physical Medicine & Rehabilitation, Johns Hopkins University, Baltimore, MD
[g]Department of Medicine, Division of Pulmonary and Critical Care Medicine, Johns Hopkins University, Baltimore, MD
[h]Department of Speech Voice and Swallowing, Manchester University NHS Foundation Trust, United Kingdom
[i]Department of Physiotherapy, Austin Health, Melbourne, Victoria, Australia
[j]Department of Otolaryngology–Head & Neck Surgery, Stanford University School of Medicine, CA
[k]Department of Respiratory Medicine, Austin Health, Melbourne, Victoria, Australia
[l]Anaesthetics & Intensive Care Medicine, Manchester University NHS Foundation Trust, United Kingdom
[m]Department of Otolaryngology–Head & Neck Surgery, Icahn School of Medicine at Mount Sinai, New York, NY
[n]Department of Neurodegeneration, Hertie Institute for Clinical Brain Research, Tübingen, Germany
[o]Redenlab, Melbourne, Victoria, Australia
[p]Department of Otolaryngology–Head & Neck Surgery, University of Michigan Medical School, Ann Arbor

Correspondence to Charissa J. Zaga: charissa.zaga@austin.org.au and Martin B. Brodsky: mbbrodsky@jhmi.edu

Charissa J. Zaga and Vinciya Pandian contributed equally to the article.

Disclosure: *The authors have declared that no competing interests existed at the time of publication.*

Editor-in-Chief: Julie Barkmeier-Kraemer
Received April 14, 2020
Revision received May 12, 2020
Accepted May 26, 2020
https://doi.org/10.1044/2020_AJSLP-20-00089

SARS-CoV-2 (severe acute respiratory syndrome coronavirus 2), the virus responsible for COVID-19 disease, has high transmissibility. Speech-language pathologists (SLPs) and other frontline health care workers caring for patients with tracheostomy are at increased risk of infection because of frequent exposure to mucosal surfaces, secretions, and aerosols. In awake patients, it must be assumed that reflexes—specifically sneezing and coughing—are grossly intact, resulting in high probability of aerosolization during procedures. SARS-CoV-2 has significantly higher infectivity than the genetically similar coronaviruses responsible for severe acute respiratory syndrome (SARS-CoV) and Middle East respiratory syndrome (MERS-CoV) that occurred in 2003 and 2012, respectively (Tay et al., 2020). Health care worker infection with COVID-19 was noted dating back to December 31, 2019, with initial reports from Wuhan, China (World Health Organization, 2020; Xiang et al., 2020). As of May 12, 2020, a disquieting > 1,000 health care workers' deaths were documented from COVID-19 (Medscape Medical News, 2020), bringing the urgent need for guidance to the fore.

Transmission of COVID-19 occurs via airborne particles and respiratory droplets that become aerosolized and land on surfaces, sometimes for lengthy durations (van Doremalen et al., 2020; Wilson et al., 2020). Aerosol-generating procedures (AGPs) induce production of small, light particles that remain suspended in the air for prolonged periods, and these particles are produced in greater quantity than would normally occur with breathing or talking. AGPs are associated with increased risk of coronavirus transmission to health care workers (Tran et al., 2012). Major procedural sources of such aerosols include intubation and extubation, bag mask ventilation, endoscopy (e.g., bronchoscopy, laryngeal endoscopy), noninvasive ventilation, and tracheostomy (Heinzerling et al., 2020). Several procedures routinely performed in hospitals can also generate aerosols, including completion of a physical exam, sputum induction, chest physiotherapy, cuff deflation, tracheostomy tube changes, and suctioning of secretions (Brewster et al., 2020; Davies et al., 2009; England, 2020; Heinzerling et al., 2020; Tay et al., 2020; Thomas et al., 2020; Tran et al., 2012). Prior to the COVID-19 pandemic, there was virtually no consideration for how speech-language pathology procedures may generate aerosols, infectious or otherwise.

COVID-19 viral loads peak near time of symptom onset (To et al., 2020), and patients with severe disease may have protracted viral shedding beyond 20 days (Laxminarayan et al., 2020). Additionally, tracheal aspirates may remain positive for the SARS-CoV-2 virus long after nasal and oropharyngeal swabs become negative (Wolfel et al., 2020). Speech-language pathology organizations have released preliminary guidelines and position statements on patient management, personal protective equipment (PPE), and risk minimization (American Speech-Language-Hearing Association, 2020a, 2020b; Australia and New Zealand Intensive Care Society, 2020; Australian Sleep Association, 2020; ENTUK, 2020; National Institute for Health and Care Excellence [NICE], 2020; National Tracheostomy Safety Project, 2020; Royal College Speech and Language Therapists [RCSLT], 2020; Speech Pathology Australia, 2020a, 2020b). Clinical evaluation of swallowing; videofluoroscopic swallow study (VFSS); flexible laryngoscopy, including flexible endoscopic evaluation of swallowing (FEES); rigid stroboscopy; laryngectomy management; and tracheostomy management have all been identified as AGPs by speech-language pathology organizations (American Speech-Language-Hearing Association, 2020a, 2020b; RCSLT, 2020; Speech Pathology Australia, 2020a, 2020b). This guidance is pivotal, given emerging evidence of high viral shedding of COVID-19 in the nasopharynx, saliva, and sputum (To et al., 2020; W. Wang, Xu, et al., 2020), to which SLPs are potentially exposed during clinical procedures.

The prevalence of health care professionals succumbing to the COVID-19 infection has been estimated at 20% (Remuzzi & Remuzzi, 2020). SLPs who participate in multidisciplinary teams (MDTs) must therefore carefully balance the imperative to maximize safety and minimize risk of exposure with the need to provide the highest fidelity evaluation. In order to mitigate risks to health care workers, modification to usual tracheostomy management should be considered.

We summarize the best evidence available at the time of publication to guide considerations for tracheostomy practice that include triaging, indirect and direct assessments, facilitating communication, tracheostomy weaning, and decannulation. An overview of suggested modifications to clinical practice is presented in Table 1.

The Role of Speech-Language Pathology in the Intensive Care Unit During COVID-19 Pandemic

The demand for speech-language pathology service in the intensive care unit (ICU) fluctuates based on the volume of tracheostomy procedures. In the high-acuity phase, the majority of patients in the ICU will be intubated and mechanically ventilated. Most will be heavily sedated during the first 7–10 days (possibly longer) in order to facilitate aggressive ventilatory strategies and therapies, such as prone positioning (Bein et al., 2016). While most patients who survive critical illness improve and undergo trials of primary extubation, tracheostomy is considered in those who require prolonged ventilation, as well as those who either fail, or are a high risk of failing, a primary extubation (Khammas & Dawood, 2018; Meng et al., 2016). Mortality rates from patients who are COVID-19 positive and admitted to critical care units vary significantly, depending on admission criteria, ventilatory strategy (noninvasive or

Table 1. Suggested modifications to tracheostomy care during the COVID-19 pandemic.

Classification	Patient group	Specific recommendations in COVID-19 patients
Relative contraindications	Tracheostomy with invasive mechanical ventilation	• Minimize deflating cuff for ventilator-adjusted leak speech, one-way speaking valve in-line with the ventilator • Minimize above cuff vocalization with inflated cuff • Minimize use of saline irrigation in airway or other liquids that may be aerosolized
Precautions	Tracheostomy without invasive mechanical ventilation	• Check cuff pressures, and carefully consider the risks of cuff deflation • Defer one-way speaking valve in patients until viral load has had time to wane (RTqPCR negative is ideal) • Consider delaying standard early intervention • Consider deferring testing of gag reflex, inducing voluntary cough, palpating the hyolaryngeal movement, and oral trials
Proactive measures	Tracheostomy or laryngectomy	• Provide augmentative and alternative communication • Identify supportive communication strategies for all patients including non–English-speaking patients and patients with cognitive impairments • Ensure adequate education regarding device use and/or placement • Collaboration with the MDT; use of spacers and/or closed systems for delivery of mists

Note. RTqPCR = reverse transcription quantitative polymerase chain reaction; MDT = multidisciplinary team.

invasive), illness severity, comorbidity, and age. The 30-day survival of patients receiving mechanical ventilation within the first 24 hr of critical care is < 50% (Intensive Care National Audit & Research Centre, 2020).

The timing of tracheostomy insertion for patients with chronic respiratory failure is influenced by several factors. Concern for higher viral load and infectivity during the early course of illness may provide a rationale for late tracheostomy, after viral loads have presumably waned. In contrast, early tracheostomy may be suggested in cases where there are limited ventilators, staff, and ICU space or where there are concerns for failed extubation due to laryngeal edema and/or stridor. All of these factors are in addition to daily considerations, such as improving pulmonary gas exchange, supporting lung healing, and avoiding additional medical complications and comorbidities.

Endotracheal and tracheostomy tubes can facilitate a closed circuit for ventilation via an inflated cuff, effectively minimizing aerosolization of viral particles. Based on current ICU COVID-19 guidelines in the United Kingdom and in Australia (Australia and New Zealand Intensive Care Society, 2020; NICE, 2020) and influenced by professional associations and institutional support independent of geography (Centers for Disease Control and Prevention, 2020b), speech-language pathology services may be more common during the recovery phase than in ICU. SLPs have an important role in the facilitation of nonverbal communication, such as augmentative and alternative communication (AAC) for alert, intubated patients in the ICU (Zaga et al., 2019). Additionally, the management of delirium is a key focus for SLP input, in conjunction with the MDT, at this high-acuity stage.

Tracheostomy Management

Patients who are ventilated or receiving pressure support will usually have an inflated tracheostomy tube cuff. The inflated cuff will help mitigate the risks of aerosol spread during routine tracheostomy care procedures, such as suctioning (NICE, 2020). Above cuff vocalization with an inflated cuff and strategies that necessitate cuff deflation are AGPs. Cuff deflation may be performed during the weaning process or primarily to facilitate ventilator-adjusted leak speech or one-way speaking valve use.

Tracheostomy With Mechanical Ventilation

Tracheostomy tubes with a subglottic suction port are advantageous because they allow for above cuff secretion clearance. For COVID-19–positive or suspected patients, communication interventions that are AGP (i.e., one-way speaking valves in-line with the ventilator, ventilator-adjusted leak speech, and above cuff vocalization with a cuff inflated) should be minimized to avoid risk of SARS-CoV-2 exposure to other patients, visitors, and health care workers. There may be situations when brief periods of cuff deflation are necessary. Reasons for cuff deflation include the need to assess for air leak to facilitate communication and guiding tracheostomy change/decannulation. A careful risk–benefit analysis for cuff deflation should be performed. Regardless of the procedure, the least number of people to accomplish the task should be present in a patient's room, reducing the burn rate of PPE and minimizing personnel exposure.

Special precautions are warranted during patient consultations by physicians, nurses, and respiratory/physiotherapists. Viral shedding may be prolonged in critically ill patients (Laxminarayan et al., 2020), and patients formerly negative may become infected while in the hospital. Moreover, in February 2020, the rate of false-negative test results was reported as high as 30%–50% (Y. Wang, Kang, et al., 2020). For patients who have a COVID-19–negative result or patients who are considered low risk for COVID-19 after screening, cuff deflation to facilitate communication should be pursued carefully. For routine care, basic PPE

such as a surgical mask, apron, gloves, and eye protection should be worn, maintaining physical distancing practices consistent with public health and local organizational guidelines (Bahl et al., 2020). For flexible endoscopy, rigid endoscopy, and other significant aerosol-producing procedures, enhanced PPE, such as FFP3 or N95 with face shield, is considered a minimum standard; powered air-purifying respirator is the preferred equipment. Suggested protocols adapted from the surgical literature are shown in Table 2 (see Figure 1).

Tracheostomy Without Mechanical Ventilation

Protocols for cuff deflation to facilitate communication require reappraisal in the presence of COVID-19. Conventional weaning approaches encourage early cuff deflation (i.e., deflation that occurs as soon as the patient is able to tolerate without desaturation) for communication. Early cuff deflation is discouraged in COVID-19–positive patients. Patients with a tracheostomy who are not invasively ventilated utilize an open respiratory circuit. Cuff deflation for one-way speaking valve use or capping is presumed to increase aerosolization of viral particles in the already open circuit, but data are lacking. Placement of a one-way speaking valve or capping to restore airflow through the upper airway changes the direction and flow rate of expired air and increases the likelihood of coughing. Although the velocity of expired air with coughing has been measured at 3 times that of speech, droplet sizes are approximately similar (Chao et al., 2009). For patients

Table 2. Risk stratification by patient status (scheme adapted from Stanford Health Care, with permission).

Aerosol-generating procedures involving diagnosis and/or instrumentation including but not limited to:
clinical evaluation of swallowing; videofluoroscopic swallow study; fiberoptic endoscopic evaluation of swallowing; flexible laryngoscopy with or without videostroboscopy; clinical evaluation of speech production or swallowing assessments; assessment of velopharyngeal function, including acoustic, aerodynamic, and nasality testing; and laryngeal function studies including ultrasound. It is preferable for patients to undergo testing within 48 hr of procedures. Staff not wearing personal protective equipment should leave the room. Ventilated procedure rooms are preferred.

Risk and definition	Patient wears	Provider/staff wear
High risk to provider: Consider delaying or discussing • Active COVID-19–positive patient • Influenza-like symptoms • Patients under investigation for COVID-19	Surgical mask	• Single-use N95 or equivalent (FFP3 or PAPR) • Face shield with/without goggles • Gown • Gloves
Low risk to provider: • Asymptomatic, untested patients or COVID-19–negative in 48 hr preceding the procedure • If possible, test patients within 48 hr of procedure	Surgical mask	• Surgical mask • Goggles or face shield • Gown • Gloves

Aerosol-generating procedures involving prostheses, tracheostomy, or stoma care including but not limited to:
tracheostomy care; laryngectomy care; tracheoesophageal puncture prosthesis (TEPP) placement, fitting, or change; one-way speaking valves; suctioning (in-line suction, HME, and/or humidification); cuff deflation for speech or leak assessment; providing education relating to electrolarynx; or use of TEPP speech.

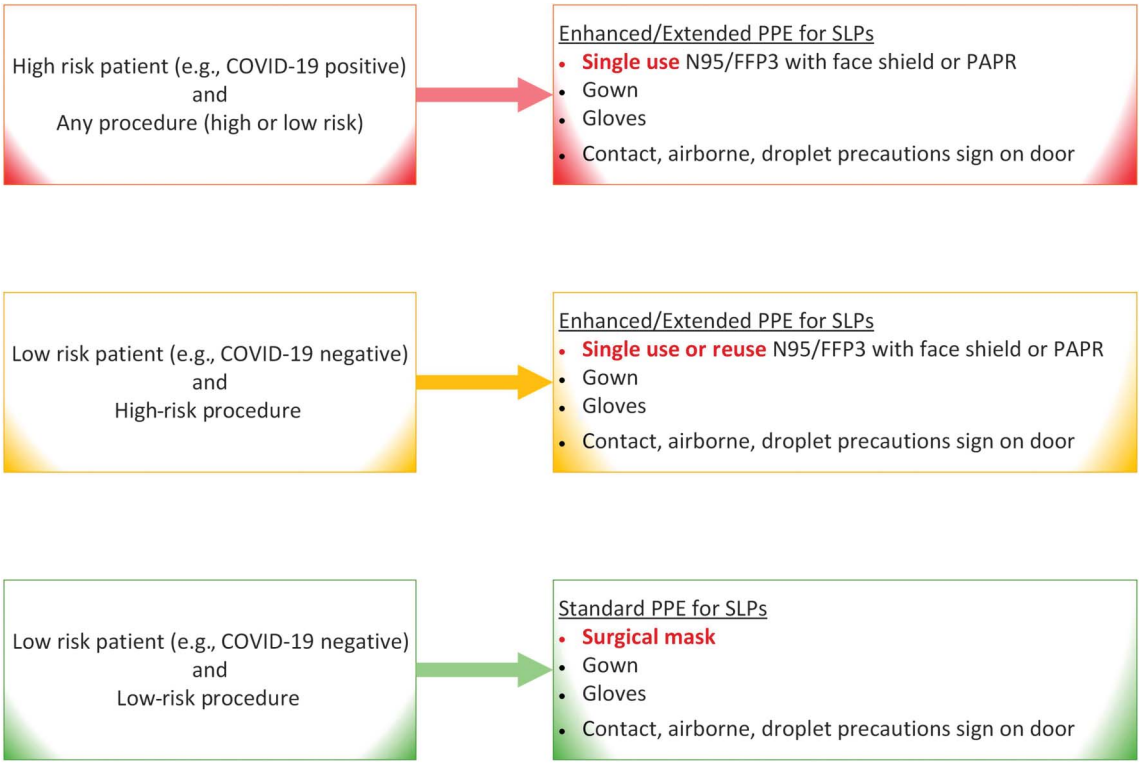
Risk and definition	Patient wears	Provider/staff wear
High risk to provider: Consider delaying or discussing • Active COVID-19–positive patient • Influenza-like symptoms • Patients under investigation	Surgical mask	• Single use N95 or equivalent (FFP3 or PAPR) • Goggles or face shield • Gown • Gloves
Low risk to provider: Asymptomatic patients or COVID-19 negative in last 48 hr	Surgical mask	• Surgical mask • Goggles or face shield • Gown • Gloves

Nonprocedure encounters in nonimmunocompromised patients
*If immunocompromised (in active chemotherapy, radiation, immunotherapy, < 1 year of solid organ transplant, chronic immunosuppression therapy, pregnant), both patient and provider should wear surgical masks unless patient is high risk.

Risk and definition	Patient wears	Provider/staff wear
High risk to provider: Any exam in: • Active COVID-19–positive patient • Influenza-like symptoms • Patients under investigation for COVID-19	Surgical mask	• Single use N95 or equivalent (FFP3 or PAPR) • Goggles or face shield • Gown • Gloves
Low risk to provider: Other exam in: • Asymptomatic, untested, or COVID-19–negative patients	Surgical mask	• Surgical mask • Gloves

Note. Recommendations are subject to change. Physical distancing is warranted at all times where possible. Surgical masks as feasible where maneuvers permit. PAPR = powered air-purifying respirator; HME = heat moisture exchange.

Figure 1. Personal protective equipment (PPE) stratification by patient's COVID-19 status and procedure risk status. This figure provides guidance for speech-language pathologists (SLPs) on what type of PPE to use and what precautionary signs should be placed on the patient's door for patients who are COVID-19 positive and those who are not during the COVID-19 era. The guidance provided also takes the risk status of the procedure into consideration. PAPR = powered air-purifying respirator.



who have known or suspected COVID-19, a conservative approach is recommended when assessing upper airway patency to guide tracheostomy weaning and readiness for decannulation. In addition, it is prudent for patients to wear a surgical mask over their tracheostomy tube and mouth while their cuff is deflated to minimize virus transmission (Howard et al., 2020; Kai et al., 2020; see Figures 2 and 3).

The threshold for performing flexible endoscopy is an evolving area with varying criteria across geographies and institutions. When oral or nasal endoscopy is considered to visualize the laryngopharynx, it is best performed after discussion with the physician team or MDT. The value of diagnostic information derived from endoscopy should be weighed against the risk of infectious transmission to health care workers. In emergency conditions, such as impending airway compromise, an emergency airway response team may use a variety of different approaches to rapidly secure the airway. Emergency airway responses have been associated with infection to health care works, including superspreading events (Standiford et al., 2020). During the early exploration and discovery of SARS-CoV-2, some sources advised SLPs to avoid performing such procedures due to the high aerosol generation (ENTUK, 2020), instead relying on expertise in the clinical (i.e., noninstrumental) assessment of voice, airway protection, oral secretion management, and swallow function. Months later, after updated information has been published, the needle has moved a bit, and caution while performing select procedures is recommended (Dysphagia Research Society [DRS], 2020). Ensuring SLP safety takes precedence in decision making; however, early decannulation is an important goal, as it promotes earlier discharge from the hospital and re-allocation of resources.

Attempts to balance these competing demands may involve delaying cuff deflation for one-way speaking valves or capping of tracheostomy tube until the need for mechanical ventilation has ceased or is deemed to be stable by a physician or MDT. Once safe and appropriate, airway protection and upper airway patency assessments may be conducted. Compared with standard practice, SLPs may opt to use a shorter period of patient-demonstrated tolerance of cuff deflation and use of a one-way speaking valve. Collaboration with MDT members, including nurses and respiratory therapists, will help to guide the timing of SLP assessment (Brenner et al., 2020; McGrath, Wallace, et al., 2020). Risk assessment for aerosol generation and infection, based on our expert opinions from the review of the literature and current practice standards, is shown in Table 3. Recommended approaches relating to PPE are shown in Table 4.

Figure 2. Transmissions probability. Conceptual depiction of efficacy of masks in prevention of infectious transmission of COVID-19. The preponderance of discussion on personal protective equipment has focused on what is worn by health care workers; however, some data suggest that masks worn by patients may also have an important role in reducing risk of transmission. The relative probability of transmission is depicted based on whether the mask is worn by COVID-19 carrier, healthy contact, or both (Howard et al., 2020; Kai et al., 2020). Image use with permission, courtesy of Passy-Muir, Inc., Irvine, CA.

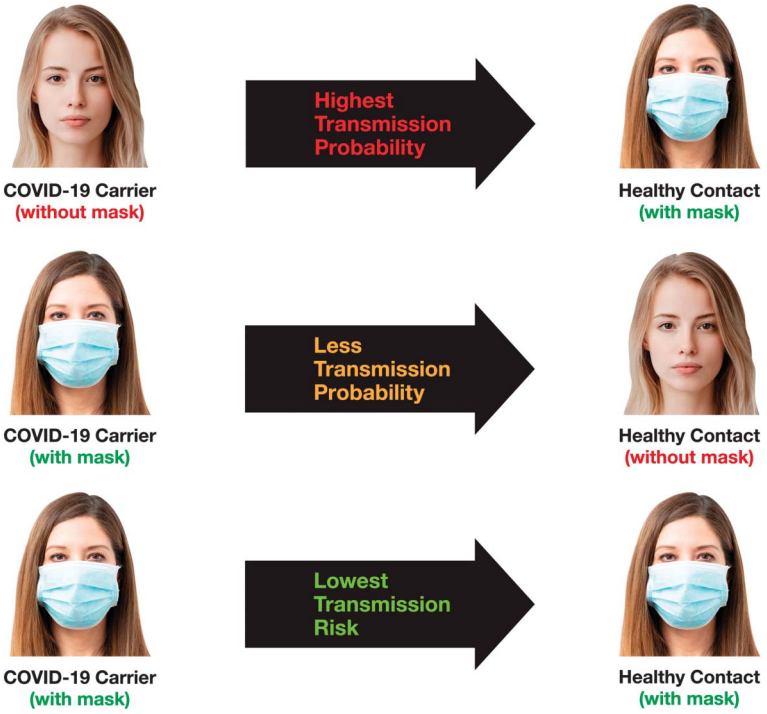


Figure 3. Manikin wearing two surgical masks to minimize virus transmission. This image portrays a manikin with a surgical mask over the tracheostomy tube and a second surgical mask over the mouth and nose as recommended by Howard et al. (2020) and Kai et al. (2020).

Tracheostomy Weaning and Readiness for Decannulation

SLPs are recommended to minimize or cease performing AGPs and, as such, may need to adapt their clinical assessments and decision making in conjunction with the MDT to guide safe management and appropriate timing of decannulation. SLPs need to balance the risk of aerosolization with an open respiratory circuit and the benefit of facilitating safe decannulation as early as possible. As clinical procedures are increasingly resumed, endoscopy may be used, with due precautions, for assessing readiness for decannulation. Decannulating patients sooner may yield a quicker hospital discharge, enabling greater patient flow through the hospital and increasing bed capacity and resources (Cherney et al., 2020). Joint decision making with the MDT will be critical to weigh risks and benefits.

Patients Living in the Community or Long-Term Care Facilities With a Tracheostomy

Patients who have failed decannulation attempts in the acute setting or who are unsafe for decannulation may

Table 3. Classification of risk/aerosol generation by speech-language pathology intervention (expert opinion).

Risk level	Encounter or procedure type
Instrumental/diagnostic procedures	
High risk	Clinical evaluation of swallowing
	Iowa Oral Performance Instrument tongue strength diagnostics
	Videofluoroscopic swallow study
	Flexible endoscopic evaluation of swallowing
	Rigid endoscopy
	Flexible laryngoscopy with or without videostroboscopy
	High-resolution manometry
	One-way speaking valve evaluation
	Tracheoesophageal puncture prosthesis evaluation
	Acoustic, aerodynamic, and nasality testing
Therapeutic interventions and procedures	
High risk	Tracheostomy care, assessment and management
	Laryngectomy care, assessment and management
	Stoma care
	Iowa Oral Performance Instrument tongue strength therapy
	High-resolution manometry
	Pharyngeal electrical stimulation
	Expiratory muscle strength training
Low risk	Surface electromyography
Nonprocedural encounters	
Moderate risk	Language or communication evaluation
	Speech evaluation
	Voice evaluation
	Swallowing compensatory/exercise therapy
General procedures (nursing, respiratory [physio]therapy, speech-language pathology)	
High risk	Suctioning
	Cuff deflation
	Exchange of tracheostomy
	Provocative maneuvers (expectoration, cough, manipulation)

be discharged with their tracheostomy. Comprehensive education is required to ensure a safe discharge and minimize risk for readmission. Patients with a preexisting tracheostomy entering the hospital will require special considerations during the COVID-19 pandemic. In patients with a cuffless tracheostomy tube, consideration for a cuffed tube is warranted if the patient is either COVID-19 positive or not confirmed. Patients with a permanent tracheostomy will need similar considerations. This approach may be challenging for these patients and their caregivers, particularly if they are admitted for reasons unrelated to respiratory status.

Routine tracheostomy tube changes may be deferred when the patient is COVID-19 positive or not confirmed negative. Some institutions may assume that every patient is COVID-19 positive until proven otherwise. Admissions for the trial of decannulation may be postponed during the pandemic. Tracheostomy tube changes may be deferred while in the hospital or clinical setting, with tube changes occurring in the community by trained staff. Telephone or telehealth support and clinical follow-up play an increasingly important role in ensuring that patients with a long-term tracheostomy are safely cared for in the community. Many patients with chronic tracheostomy also have underlying risk factors for a more severe clinical course with COVID-19 due to oncological diagnosis, chronic obstructive pulmonary disease, or age (Bhatraju et al., 2020; Grasselli et al., 2020; Pandian et al., 2012; Silverman et al., 2020). Therefore, approaches that are conducive to social distancing and that minimize exposure to hospital settings are preferred. Virtual visits, coordination of care for equipment, and other telehealth service delivery can help ensure the safety of these patients in the community. Patients with a long-term tracheostomy who are living in the community should be encouraged to preplan where they would be admitted or if they would be admitted to a hospital should they become ill.

Oral Intake and Swallowing Assessments

Routine VFSS and FEES has been minimized or stopped in some communities due to concerns for aerosol generation. As a result, SLPs will need to rely on their clinical expertise in assessing airway protection, oral secretion management, and swallowing. The majority of COVID-19–positive patients will present with severe ICU-acquired weakness with associated reduced respiratory and swallowing status (Brodsky, Levy, et al., 2018; Fan et al., 2014, 2009; Vanhorebeek et al., 2020). Initiation of cuff deflation to assess airway protection and swallowing function is associated with aerosol generation and should only be performed with N95 or higher PPE. Similarly, the timing of clinical swallowing examinations and initiation of oral intake should be carefully planned. Clinical swallowing examinations should be performed with basic PPE, even for patients who are confirmed COVID-19 negative adhering to social distancing measures, such as positioning oneself 6 feet from the patient in a side-by-side fashion rather than standing face-to-face (Australian Sleep Association, 2020; RCSLT, 2020).

Several additional modifications may include avoidance of gag reflex and voluntary cough testing and not palpating the hyolaryngeal movement during swallowing trials (RCSLT, 2020). Deferral of oral intake until after decannulation may be necessary to minimize the potential for coughing and throat clearing behaviors in response to oral boluses. This approach will likely predispose patients to an increased duration of dysphagia and related therapy requirements in the post–COVID-19 recovery phase, due to periods of prolonged intubation and prolonged period of nil per os for oral feeding. SLPs may add loss of taste and smell to their case history and review with patients during the course of their disease (Lechien et al., 2020; Mao et al., 2020).

Communication

Communication is crucial to ensure safe care and improve quality of life (Pandian et al., 2020). For awake and

Table 4. Proper use of personal protective equipment (PPE) to avoid exposure during aerosol-generating procedures (AGPs) in COVID-19–positive patients.

Consideration	Strategies
Use droplet precautions	Protection from aerosol droplets requires eye protection, gown, gloves, mask; members of the health care team require an updated fit FFP3 or N95 mask or higher equivalent particulate respirator for AGPs.
Practice donning/doffing	Staff should become proficient with safely donning and (especially) doffing PPE prior to engaging in AGPs. Spot checks or "buddy checks" can help to identify breaches in technique. Closing eyes during removal of glasses decreases risk of conjunctival exposure.
Endoscopy	Depending on geography, endoscopy may be reserved for emergencies during the COVID-19 pandemic. Standards are evolving; PPE is worn by the clinician; patient should wear a surgical mask where feasible (drop mask below the nose for laryngoscopy) in the event of patient coughing/sneezing.
Be alert to carriers	Many patients with COVID-19 are undocumented, either asymptomatic or in prodromal state; in health care settings with COVID-19–positive patients, clinicians should be aware of possibility that any patient may have COVID-19 infection, applying heightened precautions in persons under investigation.
Use experienced personnel	In order to perform procedures safely, expeditiously, and with low risk, experienced individuals should perform procedures, with the fewest assistants possible. Teaching may give way to safety considerations during the pandemic in order to maximize safety of the health care team.
Optimize timing	Viral shedding can exceed 20 days. When airway procedures cannot be postponed, the focus is on closed-circuit airway management and minimizing aerosol generation to maximally protect clinicians and staff.
Prepare equipment	Careful advanced preparation for procedures improves speed and safety, reducing risk of exposure; instrument setups should be standardized, and suction, cautery, lighting, and positioning should all be optimized. Plan entry, setup, and exit from the patient's room before entering.
Identify procedure sites	Many procedures, such as endoscopy, suctioning, or cuff deflation can be considered AGP. Conducting AGPs in a dedicated location may reduce risk to health care workers and for patients.

alert patients who are invasively ventilated either via an endotracheal tube or tracheostomy, AAC should be incorporated to facilitate speech (Zaga et al., 2019). SLPs play a pivotal role in educating multidisciplinary staff who are providing face-to-face care to COVID-19–positive or suspected patients regarding salient AAC methods and supportive communication strategies. Resource provision for patients with non–English-speaking backgrounds, patients with cognitive and communicative impairments, and those with low health literacy should also be considered. These patient groups have increased risk of poorer health outcomes (Bostock & Steptoe, 2012; Hahn & Cella, 2003; Hemsley et al., 2019; Neilsen-Bohlman et al., 2004; Nordehn et al., 2006) and diminished quality of life (Freeman-Sanderson et al., 2018, 2016). Additionally, patients with new cognitive–communicative impairments, such as those resulting from ICU-acquired delirium and new neurological events (e.g., cerebrovascular accident), will require AAC support, tailored to their functional abilities and reviewed over their admission (Mao et al., 2020).

Psychological distress related to impaired communication due to mechanical ventilation in the ICU is well documented (Guttormson et al., 2015; Happ et al., 2004; Khalaila et al., 2011; Myhren et al., 2011). Difficulty communicating precedes reduced capacity to engage with others, leading to a higher risk of the development of posttraumatic stress disorder following discharge from the ICU (Alasad & Ahmad, 2005; Engstrom et al., 2013; Samuelson, 2011). In fact, awake patients who are mechanically ventilated ranked speech as their first priority after breathing and airway comfort (Pandian, 2013). The necessity for health care professionals to wear PPE is likely to exacerbate communication barriers and feelings of anxiety, panic, fear, and helplessness (Guttormson et al., 2015; Happ et al., 2004; Khalaila et al., 2011; Myhren et al., 2011). Moreover, with many patients residing in isolation rooms—without visitors and a reduced number and duration of health care professional contact—the negative psychosocial impacts will be significant and longstanding. These patients present a unique opportunity for SLPs to consider supportive communicative strategies and resources, together with the MDT. Cognitive stimulation and orientation tasks may also support the patient's psychological well-being.

Considerations in Head and Neck Cancer Patients

SLPs may also be involved in the care of patients who have artificial airways (tracheostomy or laryngectomy) for reasons unrelated to COVID-19 or primary respiratory failure (Kligerman et al., 2020; Ku et al., 2020; Silverman et al., 2020). These patients include those with laryngectomy and chemoradiated patients with organ preservation and needs addressed by SLPs related to speech and swallowing. Additional consideration is warranted due to needs that arise both in the context of acute ablative surgery and chronic care needs (DRS, 2020). Many of these patients have undergone chemoradiation that affects speech, swallowing, and wound healing around sites of prostheses. These patients commonly have complex needs relating to speech, swallowing, or both (Barnhart et al., 2018; Kraaijenga

et al., 2015; Logemann et al., 2008; Wall et al., 2013). Late complications of radiation, including dysphagia, voice changes, and reduced quality of life, can persist well after the malignancy has been effectively treated (Barnhart et al., 2018; Kraaijenga et al., 2015; Lazarus et al., 1996; Logemann et al., 2008; Wall et al., 2013). Such patients have a high prevalence of chronic obstructive pulmonary disease and coronary artery disease. As a result, the SARS-CoV-2 infection carries increased risk of severe disease course and mortality. Identifying approaches for telehealth or temporizing measures that avoid direct care in the hospital may mitigate risk (Calton et al., 2020; Gadzinski et al., 2020; Moazzami et al., 2020; Rockwell & Gilroy, 2020). Also, amid a surge in patients with a tracheostomy, there may be an increase in the already significant risk of a laryngectomy stoma being misconstrued and inappropriately treated as a tracheostomy (McGrath et al., 2012; Rassekh et al., 2015).

Surgical removal of the larynx for laryngeal cancer (or far less commonly mechanical injury to the neck or chemical injury to the larynx) has profound implications for communication (Moon et al., 2014; Patel et al., 2018). Tracheoesophageal puncture prosthesis (TEPP) with a one-way speaking valve is typically performed to facilitate speech (Hutcheson et al., 2011; Stafford, 2003). With the increase in the incidence of COVID-19, TEPPs are being avoided to decrease clinician risk of airway droplets exposure. These patients may experience frustration, anxiety, isolation, and become depressed. Esophageal speech or an electrolarynx may be offered as alternatives for communication.

Regardless of the mode of communication, SLPs must consider the type of PPE when encountering patients with a laryngectomy, since these patients have an open airway that causes aerosolized spray during breathing and speaking. These interactions include considerations for suctioning, as well (see Table 2; DRS, 2020). Physical distancing remains paramount, and telehealth should be considered (Calton et al., 2020; Gadzinski et al., 2020; Moazzami et al., 2020; Rockwell & Gilroy, 2020; Wall et al., 2017). An additional layer of protection should be sought by ensuring that the patient wears a laryngectomy tube or stoma base with a heat and moisture exchanger at all times. Patients with laryngectomy may experience pharyngeal dysphagia (Ward et al., 2002). In addition, for those with TEPP, counseling regarding the use of prosthesis plugs and dietary modifications (i.e., thickening liquids) during meals is recommended to reduce the risk of aspiration when voice prostheses are leaking and cannot be imminently changed (Brenner et al., 2007; Kligerman et al., 2020; Ku et al., 2020).

Expected Complications and Challenges

Complications that are expected to arise from the COVID-19 pandemic most likely stem from modifications to speech-language pathology practice designed to avoid the spread of SARS-CoV-2. There is evolving guidance from various organizations to maintain a closed system, avoiding air leak around the cuff (Cook et al., 2020). SLPs need to work closely with respiratory therapists to ensure that the cuff pressures are being monitored at least twice per day and that they are within acceptable ranges (Hockey et al., 2016).

Many hospitals are avoiding placement of a tracheostomy for patients with COVID-19, following professional society guidance (Sommer et al., 2020), with the understanding that patients will declare themselves as too sick to recover or recover within 18 days (Bhatraju et al., 2020). Hospitals are also deferring placement of a tracheostomy for patients without COVID-19 because of the rate of false negatives for COVID-19 testing (ENTUK, 2020; Y. Wang, Kang, et al., 2020) and physician fear of SARS-CoV-2 exposure. Such concerns are further exacerbated by the paucity of powered air-purifying respirators and PPE for clinicians involved with the surgery.

Prolonged endotracheal intubation places patients at risk for laryngeal injury (Brodsky, Levy, et al., 2018; Shinn et al., 2019). Survivors of COVID-19 who have been intubated for prolonged periods may suffer vocal cord injury, desensitization, laryngopharyngeal weakness, epiglottic weakness, or subglottic stenosis, as well as overall weakness and deconditioning that might result in reduced respiratory effort or support. SLPs need to be attuned to identifying underlying causes of the patient's dysphonia and dysphagia. Timely referrals from the physician teams are required to address the immediate and potential long-term complications to voice and swallowing functions.

The typical duration of sedation for patients with COVID-19 is also expected to increase with prolonged endotracheal intubation and the need for prone positioning (Alhazzani et al., 2020; Meng et al., 2020). With increasing evidence supporting therapeutic benefit of prone positioning and concerns around unplanned extubations (Bhatraju et al., 2020; Grasselli et al., 2020; Lucchini et al., 2020; Yamamoto et al., 2020), increased sedation may result in weakness and cognitive impairment requiring expertise of the SLPs (Pandharipande et al., 2013; Rengel et al., 2019). Increased durations of sedation will further contribute to ICU-acquired weakness (Brodsky, Levy, et al., 2018; Fan et al., 2014, 2009; Hardemark Cedborg et al., 2015).

Currently, understanding of the neurological effects of COVID-19 is limited. Emerging evidence indicates that SARS-CoV-2 targets the olfactory neurons and can cause loss of smell and taste (Lechien et al., 2020; Mao et al., 2020). In transgenic mice, SARS-CoV has been found to penetrate the brain through the olfactory bulb leading to neurological symptoms (Hardemark Cedborg et al., 2015; Lechien et al., 2020; Mao et al., 2020); there are also some rare reports of elderly individuals presenting with encephalopathy and COVID-19 (Poyiadji et al., 2020). The incidence of strokes is increased among patients with COVID-19, a finding that has drawn international attention and is under current investigation (Helms et al., 2020; Markus & Brainin, 2020). SLPs can assist patients with loss of taste if those symptoms persist. Moreover, SLPs can provide rehabilitative measures to aid patients with phonation and swallowing recovery. Swallowing impairment can arise from encephalopathy or stroke (Wilmskoetter et al., 2019), critical care–acquired

weakness (Brodsky, De, et al., 2018), and acute deconditioning secondary to viral disease process and its sequelae (Hui et al., 2005).

PPE and Clinical Practice Modifications

While PPE guidelines for COVID-19–positive and suspected cases are available (Centers for Disease Control and Prevention, 2020a; England, 2020), guidance is less consistent regarding the requirements for PPE for patients where COVID-19 testing has yielded negative cases or where clinical suspicion is low. The uncertainty regarding role for PPE in such cases is compounded by a shortage of PPE for frontline health care professionals. PPE is required of all speech-language pathology procedures that are AGPs, regardless of COVID-19 status. Due to variation in screening and testing processes, lengthy incubation periods, false-negative screening rates (Y. Wang, Kang, et al., 2020), and asymptomatic carriers of COVID-19 (Yu & Yang, 2020), SLPs should consider modifying their clinical practices to align with internationally accepted physical distancing measures (see Figure 1).

The British Thoracic Society (2020) has suggested an approach called "SPACES—Sharing Patient Assessments Cuts Exposure for Staff," which is based on the underlying principles of "maximum patient contact–minimum staff exposure." This approach suggests a minimization of the number of health care professionals that frequent the patient's bedside, where health care professionals take on a more interdisciplinary role to facilitate high-quality patient care. The advantages of such an approach extend to the reduction of PPE required and increased staff and patient safety.

From a tracheostomy management perspective, an enhanced MDT approach could be utilized to facilitate clinical assessments and decision making. For example, if a respiratory therapist were conducting chest physiotherapy or assessing the patient's secretion clearance, they could provide valuable clinical information to the SLP. The respiratory therapist can convey the patient's overall respiratory status as well as secretion load and clearance efficiency and may deflate the cuff following consultation with the SLP because they are already having direct contact with the patient. Similarly, where direct face-to-face service provision is indicated, SLPs should consider minimizing the duration of contact with the patient and the practice of physical distancing, standing side by side at a distance of 6 feet rather than face-to-face. SLPs may utilize a "buddy system" with other members of the MDT, who act as a "spotter" to guide the appropriate and safe donning and doffing of PPE prior to entering the patient's room (Brewster et al., 2020; see Table 3).

Workforce Considerations

Staff cohorting should be considered, with thought given to clinical experience and skill sets. Separating staff into discreet clinical areas may assist with reducing virus transmission between patient groups (British Thoracic Society, 2020). Incorporating backup staff is advisable in order to ensure a reserve of health care workers who can be redeployed should first-line staff become unwell, need to self-isolate, or take leave. The rate of virus growth and each hospital's ICU capacity may influence the approach to orientation and ICU competency training. Particularly during this global pandemic, junior clinicians should be encouraged and supported to discuss clinical cases with senior clinicians and supervisors. Senior clinicians can triage new referrals and facilitate discussion regarding the needs of the patient.

Lastly, there are significant dilemmas that arise with modification to standard clinical practice. Among these challenges are alterations to clinical practice changes, shortages of PPE, logistics of physical distancing during clinical care, and limiting face-to-face interactions with patients. Striking a balance between minimizing virus transmission and risk to health care professionals while providing high-quality care can exact a high emotional burden. Having to provide what may feel like diluted standards of care can create moral conflict and stress. Staff well-being, emotional debriefing, and self-care are important to minimize the risk of burnout.

Future Directions

Prospective data are needed to further guide best practices in tracheostomy care in the setting of the COVID-19 pandemic by SLPs and other members of the MDT (McGrath, Brenner, et al., 2020). In some instances, SLPs will need to manage patients and provide therapeutic recommendations in the absence of definitive diagnostic data. This situation may arise when FEES or VFSS confers unacceptable risk. Emergent technologies, such as the use of ultrasound diagnosis of laryngeal anatomy and function, may obviate the need for such AGP in select instances (Givi et al., 2020; Meng et al., 2020; Ongkasuwan, Devore, et al., 2017; Ongkasuwan, Ocampo, & Tran, 2017; Wenaas et al., 2016; Zhang et al., 2020).

There is limited evidence base on the risk associated with a wide range of AGPs, and the recommendations provided should be adapted as new data become available. Unconventional approaches to care, such as shared ventilators or continuous airway pressure intermediaries, are controversial. Should critical shortages prompt such approaches, there is an imperative to study results and their implications for SLPs and their patients. The acquisition of knowledge should inform current and future crises.

Conclusion

SLPs are frontline health care workers, serving a critical role in the multidisciplinary care of patients with a tracheostomy. Ensuring the safety of these health care workers is paramount, and speech-language pathology service provision should be adapted in response to the COVID-19 global pandemic. SLPs and other communications

disorders professionals remain dedicated to facilitating and supporting patient communication and swallowing. SLP input is also important in contributing to the MDT discussions regarding weaning, decannulation and recovery post–COVID-19. This document offers guidance for the present and is intended to be a reference for actively evolving practices.

Acknowledgments

The authors thank Kristin A. King, Vice President of Clinical Education and Research, and Stewart Goetz, Director of Marketing, Passy-Muir, Inc., for assistance with adapting and securing approvals for the images in Figure 2.

References

Alasad, J., & Ahmad, M. (2005). Communication with critically ill patients. *Journal of Advanced Nursing, 50*(4), 356–362. https://doi.org/10.1111/j.1365-2648.2005.03400.x

Alhazzani, W., Moller, M. H., Arabi, Y. M., Loeb, M., Gong, M. N., Fan, E., Oczkowski, S., Levy, M. M., Derde, L., Dzierba, A., Du, B., Aboodi, M., Wunsch, H., Cecconi, M., Koh, Y., Chertow, D. S., Maitland, K., Alshamsi, F., Belley-Cote, E., … Rhodes, A. (2020). Surviving sepsis campaign: Guidelines on the management of critically III adults with Ccoronavirus Disease 2019 (COVID-19). *Critical Care Medicine, 48*(6), e440–e469. https://doi.org/10.1097/CCM.0000000000004363

American Speech-Language-Hearing Association. (2020a). *ASHA guidance to SLPs regarding aerosol generating procedures.* https://www.asha.org/SLP/healthcare/ASHA-Guidance-to-SLPs-Regarding-Aerosol-Generating-Procedures/

American Speech-Language-Hearing Association. (2020b). *SLP service delivery considerations in health care during coronavirus*. https://www.asha.org/SLP/healthcare/SLP-Service-Delivery-Considerations-in-Health-Care-During-Coronavirus/

Australia and New Zealand Intensive Care Society. (2020). *The Australian and New Zealand Intensive Care Society (ANZICS) COVID-19 guidelines*. http://cec.health.nsw.gov.au/__data/assets/pdf_file/0004/572512/ANZICS-COVID-19-Guidelines-Version-1.pdf

Australian Sleep Association. (2020). *Consensus statement on the safe use of respiratory therapy and sleep studies to minimise aerosolisation of COVID-19*. https://www.sleep.org.au/common/Uploaded%20files/Public%20Files/COVID-19%20docs/Covid-19_Consensus%20statement%20V3.pdf

Bahl, P., Doolan, C., de Silva, C., Chughtai, A. A., Bourouiba, L., & MacIntyre, C. R. (2020). Airborne or droplet precautions for health workers treating COVID-19? *The Journal of Infectious Diseases*. https://doi.org/10.1093/infdis/jiaa189

Barnhart, M. K., Robinson, R. A., Simms, V. A., Ward, E. C., Cartmill, B., Chandler, S. J., & Smee, R. I. (2018). Treatment toxicities and their impact on oral intake following non-surgical management for head and neck cancer: A 3-year longitudinal study. *Support Care Cancer, 26*(7), 2341–2351. https://doi.org/10.1007/s00520-018-4076-6

Bein, T., Grasso, S., Moerer, O., Quintel, M., Guerin, C., Deja, M., Brondani, A., & Mehta, S. (2016). The standard of care of patients with ARDS: Ventilatory settings and rescue therapies for refractory hypoxemia. *Intensive Care Medicine, 42*(5), 699–711. https://doi.org/10.1007/s00134-016-4325-4

Bhatraju, P. K., Ghassemieh, B. J., Nichols, M., Kim, R., Jerome, K. R., Nalla, A. K., Greninger, A. L., Pipavath, S., Wurfel, M. M., Evans, L., Kritek, P. A., West, T. E., Luks, A., Gerbino, A., Dale, C. R., Goldman, J. D., O'Mahony, S., & Mikacenic, C. (2020). COVID-19 in critically ill patients in the Seattle region —Case series. *The New England Journal of Medicine, 382,* 2012–2022. https://doi.org/10.1056/NEJMoa2004500

Bostock, S., & Steptoe, A. (2012). Association between low functional health literacy and mortality in older adults: Longitudinal cohort study. *BMJ, 344,* e1602. https://doi.org/10.1136/bmj.e1602

Brenner, M. J., Floyd, L., & Collins, S. L. (2007). Role of computed tomography and bronchoscopy in speech prosthesis aspiration. *Annals of Otology, Rhinology & Laryngology, 116*(12), 882–886. https://doi.org/10.1177/000348940711601202

Brenner, M. J., Pandian, V., Milliren, C., Graham, D., Morris, L. L., Bedwell, J., Zaga, C. J., Das, P., Zhu, H., Allen, J. L., Peltz, A., Chin, K., Schiff, B. A., Randall, D., Swords, C., French, D., Ward, E., Sweeney, J., Warrillow, S., … Roberson, D. W. (2020). Global tracheostomy collaborative: Data-driven improvements in patient safety through multidisciplinary teamwork, standardization, education and patient partnership. *British Journal of Anesthesia*. Advance online publication. https://doi.org/10.1016/j.bja.2020.04.054

Brewster, D., Chrimes, N., Do, T., Fraser, K., Groombridge, C., Higgs, A., Humar, M., Leeuwenburg, T., McGloughlin, S., Newman, F., Nickson, C., Rehak, A., Vokes, D., & Gatward, J. (2020). Consensus statement: Safe Airway Society principles of airway management and tracheal intubation specific to the COVID-19 adult patient group. *The Medical Journal of Australia*. https://doi.org/10.5694/mja2.50598

British Thoracic Society. (2020). *COVID-19: Information for the respiratory community*. https://www.brit-thoracic.org.uk/about-us/covid-19-information-for-the-respiratory-community/

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. https://doi.org/10.1007/s00455-018-9901-z

Brodsky, M. B., Levy, M. J., Jedlanek, E., Pandian, V., Blackford, B., Price, C., Cole, G., Hillel, A. T., Best, S. R., & Akst, L. M. (2018). Laryngeal injury and upper airway symptoms after oral endotracheal intubation with mechanical ventilation during critical care: A systematic review. *Critical Care Medicine, 46*(12), 2010–2017. https://doi.org/10.1097/CCM.0000000000003368

Calton, B., Abedini, N., & Fratkin, M. (2020). Telemedicine in the time of coronavirus. *Journal of Pain and Symptom Management*. https://doi.org/10.1016/j.jpainsymman.2020.03.019

Centers for Disease Control and Prevention. (2020a). *Interim infection prevention and control recommendations for patients with suspected or confirmed Coronavirus Disease 2019 (COVID-19) in healthcare settings.* Retrieved May 10, 2020, from https://www.cdc.gov/coronavirus/2019-ncov/hcp/infection-control-recommendations.html

Centers for Disease Control and Prevention. (2020b). *Interim U.S. guidance for risk assessment and public health management of healthcare personnel with potential exposure in a healthcare setting to patients with Coronavirus Disease 2019 (COVID-19)*. Retrieved May 9, 2020, from https://www.cdc.gov/coronavirus/2019-ncov/hcp/guidance-risk-assesment-hcp.html

Chao, C. Y. H., Wan, M. P., Morawska, L., Johnson, G. R., Ristovski, Z. D., Hargreaves, M., Mengersen, K., Corbett, S., Li, Y., Xie, X., & Katoshevski, D. (2009). Characterization of expiration air jets and droplet size distributions immediately at the mouth opening. *Journal of Aerosol Science, 40*(2), 122–133. https://doi.org/10.1016/j.jaerosci.2008.10.003

Cherney, R. L., Pandian, V., Eastman, D., Ninan, A., Miller, B., Judkins, D., King, E., Barnes, B., Smith, N. M., Shever, L. L., Creutz, E., Casper, K. S., Carlson, M., Schneider, K. J., Davidson, P. M., & Brenner, M. J. (2020). The trach trail: A systems-based pathway to improve quality of tracheostomy care and interdisciplinary collaboration. *Otolaryngology—Head & Neck Surgery*. Advance online publication. https://doi.org/10.1177/0194599820917427

Cook, T. M., El-Boghdadly, K., McGuire, B., McNarry, A. F., Patel, A., & Higgs, A. (2020). Consensus guidelines for managing the airway in patients with COVID-19: Guidelines from the Difficult Airway Society, the Association of Anaesthetists the Intensive Care Society, the Faculty of Intensive Care Medicine and the Royal College of Anaesthetists. *Anaesthesia, 75*(6), 785–799. https://doi.org/10.1111/anae.15054

Davies, A., Thomson, G., Walker, J., & Bennett, A. (2009). A review of the risks and disease transmissions associated with aerosol generating medical procedures. *Journal of Infection Prevention, 10*(4), 122–126. https://doi.org/10.1177/1757177409106456

Dysphagia Research Society. (2020). *COVID-19 information and resources: Risk management of AGPs for dysphagia care*. https://www.dysphagiaresearch.org/page/COVID19AGPs

England, P. H. (2020). *COVID-19 personal protective equipment (PPE)*. https://www.gov.uk/government/publications/wuhan-novel-coronavirus-infection-prevention-and-control/covid-19-personal-protective-equipment-ppe

Engstrom, A., Nystrom, N., Sundelin, G., & Rattray, J. (2013). People's experiences of being mechanically ventilated in an ICU: A qualitative study. *Intensive and Critical Care Nursing, 29*(2), 88–95. https://doi.org/10.1016/j.iccn.2012.07.003

ENTUK. (2020). *ENTUK Guidelines for changes in ENT during COVID-19 pandemic*. https://www.entuk.org/entuk-guidelines-changes-ent-during-covid-19-pandemic

Fan, E., Dowdy, D. W., Colantuoni, E., Mendez-Tellez, P. A., Sevransky, J. E., Shanholtz, C., Himmelfarb, C. R., Desai, S. V., Ciesla, N., Herridge, M. S., Pronovost, P. J., & Needham, D. M. (2014). Physical complications in acute lung injury survivors: A two-year longitudinal prospective study. *Critical Care Medicine, 42*(4), 849–859. https://doi.org/10.1097/CCM.0000000000000040

Fan, E., Zanni, J. M., Dennison, C. R., Lepre, S. J., & Needham, D. M. (2009). Critical illness neuromyopathy and muscle weakness in patients in the intensive care unit. *AACN Advanced Critical Care, 20*(3), 243–253. https://doi.org/10.1097/NCI.0b013e3181ac2551

Freeman-Sanderson, A. L., Togher, L., Elkins, M., & Kenny, B. (2018). Quality of life improves for tracheostomy patients with return of voice: A mixed methods evaluation of the patient experience across the care continuum. *Intensive and Critical Care Nursing, 46,* 10–16. https://doi.org/10.1016/j.iccn.2018.02.004

Freeman-Sanderson, A. L., Togher, L., Elkins, M. R., & Phipps, P. R. (2016). Quality of life improves with return of voice in tracheostomy patients in intensive care: An observational study. *Journal of Critical Care, 33,* 186–191. https://doi.org/10.1016/j.jcrc.2016.01.012

Gadzinski, A. J., Ellimoottil, C., Odisho, A. Y., Watts, K. L., & Gore, J. L. (2020). Implementing telemedicine in response to the 2020 COVID-19 pandemic. *Journal of Urology*. https://doi.org/10.1097/JU.0000000000001033

Givi, B., Schiff, B. A., Chinn, S. B., Clayburgh, D., Iyer, N. G., Jalisi, S., Moore, M. G., Nathan, C. A., Orloff, L. A., O'Neill, J. P., Parker, N., Zender, C., Morris, L. G. T., & Davies, L. (2020). Safety recommendations for evaluation and surgery of the head and neck during the COVID-19 pandemic. *JAMA Otolaryngology—Head & Neck Surgery*. https://doi.org/10.1001/jamaoto.2020.0780

Grasselli, G., Zangrillo, A., Zanella, A., Antonelli, M., Cabrini, L., Castelli, A., Cereda, D., Coluccello, A., Foti, G., Fumagalli, R., Iotti, G., Latronico, N., Lorini, L., Merler, S., Natalini, G., Piatti, A., Ranieri, M. V., Scandroglio, A. M., Storti, E., … Pesenti, A. (2020). Baseline characteristics and outcomes of 1591 patients infected with SARS-CoV-2 admitted to ICUs of the Lombardy Region, Italy. *JAMA, 323*(16), 1574–1581. https://doi.org/10.1001/jama.2020.5394

Guttormson, J. L., Bremer, K. L., & Jones, R. M. (2015). "Not being able to talk was horrid": A descriptive, correlational study of communication during mechanical ventilation. *Intensive and Critical Care Nursing, 31*(3), 179–186. https://doi.org/10.1016/j.iccn.2014.10.007

Hahn, E., & Cella, D. (2003). Health outcomes assessment in vulnerable populations: Measurement challenges and recommendations. *Archives of Physical Medicine and Rehabilitation, 84*(Suppl. 2). https://doi.org/10.1053/apmr.2003.50245

Happ, M. B., Tuite, P., Dobbin, K., DiVirgilio-Thomas, D., & Kitutu, J. (2004). Communication ability, method, and content among nonspeaking nonsurviving patients treated with mechanical ventilation in the intensive care unit. *American Journal of Critical Care, 13*(3), 210–218. https://doi.org/10.4037/ajcc2004.13.3.210

Hardemark Cedborg, A. I., Sundman, E., Boden, K., Hedstrom, H. W., Kuylenstierna, R., Ekberg, O., & Eriksson, L. I. (2015). Effects of morphine and midazolam on pharyngeal function, airway protection, and coordination of breathing and swallowing in healthy adults. *Anesthesiology, 122*(6), 1253–1267. https://doi.org/10.1097/ALN.0000000000000657

Heinzerling, A., Stuckey, M. J., Scheuer, T., Xu, K., Perkins, K. M., Resseger, H., Magill, S., Verani, J. R., Jain, S., Acosta, M., & Epson, E. (2020). Transmission of COVID-19 to health care personnel during exposures to a hospitalized patient—Solano County, California, February 2020. *MMWR Morbidity and Mortality Weekly Report, 69*(15), 472–476. https://doi.org/10.15585/mmwr.mm6915e5

Helms, J., Tacquard, C., Severac, F., Leonard-Lorant, I., Ohana, M., Delabranche, X., Merdji, H., Clere-Jehl, R., Schenck, M., Fagot Gandet, F., Fafi-Kremer, S., Castelain, V., Schneider, F., Grunebaum, L., Angles-Cano, E., Sattler, L., Mertes, P. M., Meziani, F., & CRICS TRIGGERSEP Group. (2020). High risk of thrombosis in patients with severe SARS-CoV-2 infection: A multicenter prospective cohort study. *Intensive Care Medicine*. https://doi.org/10.1007/s00134-020-06062-x

Hemsley, B., Steel, J., Worrall, L., Hill, S., Bryant, L., Johnston, L., Georgiou, A., & Balandin, S. (2019). A systematic review of falls in hospital for patients with communication disability: Highlighting an invisible population. *Journal of Safety Research, 68,* 89–105. https://doi.org/10.1016/j.jsr.2018.11.004

Hockey, C. A., van Zundert, A. A., & Paratz, J. D. (2016). Does objective measurement of tracheal tube cuff pressures minimise adverse effects and maintain accurate cuff pressures? A systematic review and meta-analysis. *Anaesthesia and Intensive Care, 44*(5), 560–570. https://doi.org/10.1177/0310057X1604400503

Howard, J., Huang, A., Lii, Z., Tufekci, Z., Zdimal, V., Westhulzen, H. V., Von Delft, A., Price, A., Fridman, K., Tang, L., Watson, G. L., Bax, C. E., Shaikh, R., Questier, F., Hernandez, D., Chu, L. F., Ramirez, C. M., & Rimoln, A. W. (2020). *Face masks against COVID-19: An evidence review*. Preprints. https://doi.org/10.20944/preprints202004.0203.v2

Hui, D. S., Joynt, G. M., Wong, K. T., Gomersall, C. D., Li, T. S., Antonio, G., Ko, F. W., Chan, M. C., Chan, D. P., Tong, M. W., Rainer, T. H., Ahuja, A. T., Cockram, C. S., & Sung, J. J.

(2005). Impact of severe acute respiratory syndrome (SARS) on pulmonary function, functional capacity and quality of life in a cohort of survivors. *Thorax, 60*(5), 401–409. https://doi.org/10.1136/thx.2004.030205

Hutcheson, K. A., Lewin, J. S., Sturgis, E. M., Kapadia, A., & Risser, J. (2011). Enlarged tracheoesophageal puncture after total laryngectomy: A systematic review and meta-analysis. *Head & Neck, 33*(1), 20–30. https://doi.org/10.1002/hed.21399

Intensive Care National Audit & Research Centre. (2020). *ICNARC report on COVID-19 in critical care*. https://www.icnarc.org/Our-Audit/Audits/Cmp/Reports

Kai, D., Goldstein, G., Morgunov, A., Nangalia, V., & Rotkirsch, A. (2020). *Univeral masking is urgent in the COVID-19 pandemic: SEIR and agent based models, empirical validatin, policy recommendations*. Cornell University e-prints. https://arxiv.org/abs/2004.13553

Khalaila, R., Zbidat, W., Anwar, K., Bayya, A., Linton, D. M., & Sviri, S. (2011). Communication difficulties and psycho-emotional distress in patients receiving mechanical ventilation. *American Journal of Critical Care, 20*(6), 470–479. https://doi.org/10.4037/ajcc2011989

Khammas, A. H., & Dawood, M. R. (2018). Timing of tracheostomy in intensive care unit patients. *International Archives of Otorhinolaryngology, 22*(4), 437–442. https://doi.org/10.1055/s-0038-1654710

Kligerman, M. P., Vukkadala, N., Tsang, R. K. Y., Sunwoo, J. B., Holsinger, F. C., Chan, J. Y. K., Damrose, E. J., Kearney, A., & Starmer, H. M. (2020). Managing head and neck cancer patients with tracheostomy or laryngectomy during the COVID-19 pandemic. *Head & Neck, 42*(6), 1209–1213. https://doi.org/10.1002/hed.26171

Kraaijenga, S. A., van der Molen, L., Jacobi, I., Hamming-Vrieze, O., Hilgers, F. J., & van den Brekel, M. W. (2015). Prospective clinical study on long-term swallowing function and voice quality in advanced head and neck cancer patients treated with concurrent chemoradiotherapy and preventive swallowing exercises. *European Archives of Otorhinolaryngology, 272*(11), 3521–3531. https://doi.org/10.1007/s00405-014-3379-6

Ku, P. K., Holsinger, F. C., Chan, J. Y., Yeung, Z. C., Chan, B. Y., Tong, M. C., & Starmer, H. M. (2020). Management of dysphagia in the head and neck cancer patient during COVID-19 pandemic: A practical strategy. *Head & Neck*. https://doi.org/10.1002/hed.26224

Laxminarayan, R., Van Boeckel, T., Frost, I., Kariuki, S., Khan, E. A., Limmathurotsakul, D., Larsson, D. G. J., Levy-Hara, G., Mendelson, M., Outterson, K., Peacock, S. J., & Zhu, Y. G. (2020). The Lancet Infectious Diseases Commission on antimicrobial resistance: 6 years later. *The Lancet: Infectious Diseases, 20*(4), e51–e60. https://doi.org/10.1016/S1473-3099(20)30003-7

Lazarus, C. L., Logemann, J. A., Pauloski, B. R., Colangelo, L. A., Kahrilas, P. J., Mittal, B. B., & Pierce, M. (1996). Swallowing disorders in head and neck cancer patients treated with radiotherapy and adjuvant chemotherapy. *The Laryngoscope, 106*(9, Pt. 1), 1157–1166. https://doi.org/10.1097/00005537-199609000-00021

Lechien, J. R., Chiesa-Estomba, C. M., De Siati, D. R., Horoi, M., Le Bon, S. D., Rodriguez, A., Dequanter, D., Blecic, S., El Afia, F., Distinguin, L., Chekkoury-Idrissi, Y., Hans, S., Delgado, I. L., Calvo-Henriquez, C., Lavigne, P., Falanga, C., Barillari, M. R., Cammaroto, G., Khalife, M., … Saussez, S. (2020). Olfactory and gustatory dysfunctions as a clinical presentation of mild-to-moderate forms of the coronavirus disease (COVID-19): A multicenter European study. *European Archives of Otorhinolaryngology*. https://doi.org/10.1007/s00405-020-05965-1

Logemann, J. A., Pauloski, B. R., Rademaker, A. W., Lazarus, C. L., Gaziano, J., Stachowiak, L., Newman, L., MacCracken, E., Santa, D., & Mittal, B. (2008). Swallowing disorders in the first year after radiation and chemoradiation. *Head & Neck, 30*(2), 148–158. https://doi.org/10.1002/hed.20672

Lucchini, A., Bambi, S., Mattiussi, E., Elli, S., Villa, L., Bondi, H., Rona, R., Fumagalli, R., & Foti, G. (2020). Prone position in acute respiratory distress syndrome patients: A retrospective analysis of complications. *Dimensions of Critical Care Nursing, 39*(1), 39–46. https://doi.org/10.1097/DCC.0000000000000393

Mao, L., Jin, H., Wang, M., Hu, Y., Chen, S., He, Q., Chang, J., Hong, C., Zhou, Y., Wang, D., Miao, X., Li, Y., & Hu, B. (2020). Neurologic manifestations of hospitalized patients with coronavirus disease 2019 in Wuhan, China. *JAMA Neurology*. https://doi.org/10.1001/jamaneurol.2020.1127

Markus, H. S., & Brainin, M. (2020). COVID-19 and stroke—A global World Stroke Organization perspective. *International Journal of Stroke*. https://doi.org/10.1177/1747493020923472

McGrath, B. A., Bates, L., Atkinson, D., Moore, J. A., & National Tracheostomy Safety, P. (2012). Multidisciplinary guidelines for the management of tracheostomy and laryngectomy airway emergencies. *Anaesthesia, 67*(9), 1025–1041. https://doi.org/10.1111/j.1365-2044.2012.07217.x

McGrath, B. A., Brenner, M. J., Warrillow, S., Pandian, V., Arora, A., Cameron, T., Elizalde, J. A., Martinez, G. H., Truog, R. D., Block, S. D., Lui, G. C., McDonald, C., Rassekh, C. H., Atkins, J. H., Qiang, L., Vergez, S., Dulguerov, P., Antonelli, M., Pelosi, P., … Feller-Kopman, D. (2020). Tracheostomy in the COVID-19 era: Global and multidisciplinary guidance. *The Lancet Respiratory Medicine*. Advance online publication. https://doi.org/10.1016/S2213-2600(20)30230-7

McGrath, B. A., Wallace, S., Lynch, J., Bonvento, B., Coe, B., Owen, A., Firn, M., Brenner, M. J., Edwards, E., Finch, T. L., Cameron, T., Narula, A., & Roberson, D. W. (2020). Improving tracheostomy care in the United Kingdom: Results of a guided quality improvement program in 20 diverse sites. *British Journal of Anesthesia*. https://doi.org/10.1016/j.bja.2020.04.064

Medscape Medical News. (2020). *In memoriam: Healthcare workers who have died of COVID-19*. https://www.medscape.com/viewarticle/927976

Meng, L., Qiu, H., Wan, L., Ai, Y., Xue, Z., Guo, Q., Deshpande, R., Zhang, L., Meng, J., Tong, C., Liu, H., & Xiong, L. (2020). Intubation and ventilation amid the COVID-19 outbreak: Wuhan's experience. *Anesthesiology, 132*(6), 1317–1332. https://doi.org/10.1097/ALN.0000000000003296

Meng, L., Wang, C., Li, J., & Zhang, J. (2016). Early vs late tracheostomy in critically ill patients: A systematic review and meta-analysis. *The Clinical Respiratory Journal, 10*(6), 684–692. https://doi.org/10.1111/crj.12286

Moazzami, B., Razavi-Khorasani, N., Dooghaie Moghadam, A., Farokhi, E., & Rezaei, N. (2020). COVID-19 and telemedicine: Immediate action required for maintaining healthcare providers well-being. *Journal of Clinical Virology, 126,* 104345. https://doi.org/10.1016/j.jcv.2020.104345

Moon, S., Raffa, F., Ojo, R., Landera, M. A., Weed, D. T., Sargi, Z., & Lundy, D. (2014). Changing trends of speech outcomes after total laryngectomy in the 21st century: A single-center study. *The Laryngoscope, 124*(11), 2508–2512. https://doi.org/10.1002/lary.24717

Myhren, H., Ekeberg, O., & Stokland, O. (2011). Satisfaction with communication in ICU patients and relatives: Comparisons with medical staffs' expectations and the relationship with psychological distress. *Patient Education and Counselling, 85*(2), 237–244. https://doi.org/10.1016/j.pec.2010.11.005

National Institute for Health and Care Excellence. (2020). *COVID-19 rapid guideline: Critical care in adults*. https://www.nice.org.uk/guidance/ng159

National Tracheostomy Safety Project. (2020). *NSTP considerations for tracheostomy in the COVID-19 outbreak*. http://www.tracheostomy.org.uk/storage/files/NTSP%20COVID_19%20tracheostomy%20guidance%2031_3_20.pdf

Neilsen-Bohlman, L., Panzer, A., & Kindig, D. (2004). *Health literacy—A prescription to end confusion*. The National Academies Press.

Nordehn, G., Meredith, A., & Bye, L. (2006). A preliminary investigation of barriers to achieving patient-centered communication with patients who have stroke-related communication disorders. *Topics in Stroke Rehabilitation, 13*(1), 68–77. https://doi.org/10.1310/5K2W-P6CD-EFDF-8HG4

Ongkasuwan, J., Devore, D., Hollas, S., Jones, J., & Tran, B. (2017). Laryngeal ultrasound and pediatric vocal fold nodules. *The Laryngoscope, 127*(3), 676–678. https://doi.org/10.1002/lary.26209

Ongkasuwan, J., Ocampo, E., & Tran, B. (2017). Laryngeal ultrasound and vocal fold movement in the pediatric cardiovascular intensive care unit. *The Laryngoscope, 127*(1), 167–172. https://doi.org/10.1002/lary.26051

Pandharipande, P. P., Girard, T. D., Jackson, J. C., Morandi, A., Thompson, J. L., Pun, B. T., Brummel, N. E., Hughes, C. G., Vasilevskis, E. E., Shintani, A. K., Moons, K. G., Geevarghese, S. K., Canonico, A., Hopkins, R. O., Bernard, G. R., Dittus, R. S., Ely, E. W., & BRAIN-ICU Study Investigators. (2013). Long-term cognitive impairment after critical illness. *The New England Journal of Medicine, 369*(14), 1306–1316. https://doi.org/10.1056/NEJMoa1301372

Pandian, V. (2013). *Quality of life in mechanically ventilated ICU patients* [Dissertation]. Johns Hopkins University.

Pandian, V., Cole, T., Kilonsky, D., Holden, K., Feller-Kopman, D. J., Brower, R., & Mirski, M. (2020). Voice-related quality of life increases with a talking tracheostomy tube: A randomized controlled trial. *The Laryngoscope, 130*(5), 1249–1255. https://doi.org/10.1002/lary.28211

Pandian, V., Gilstrap, D. L., Mirski, M. A., Haut, E. R., Haider, A. H., Efron, D. T., Bowman, N. M., Yarmus, L. B., Bhatti, N. I., Stevens, K. A., Vaswani, R., & Feller-Kopman, D. (2012). Predictors of short-term mortality in patients undergoing percutaneous dilatational tracheostomy. *Journal of Critical Care, 27*(4), 420.e9–420.e15. https://doi.org/10.1016/j.jcrc.2011.10.003

Patel, R. S., Mohr, T., Hartman, C., Stach, C., Sikora, A. G., Zevallos, J. P., & Sandulache, V. C. (2018). Tracheoesophageal prosthesis use is associated with improved overall quality of life in veterans with laryngeal cancer. *Annals of Otology, Rhinology & Laryngology, 127*(7), 421–428. https://doi.org/10.1177/0003489418772067

Poyiadji, N., Shahin, G., Noujaim, D., Stone, M., Patel, S., & Griffith, B. (2020). COVID-19–associated acute hemorrhagic necrotizing encephalopathy: CT and MRI features. *Radiology,* 201187. https://doi.org/10.1148/radiol.2020201187

Rassekh, C. H., Zhao, J., Martin, N. D., Chalian, A. A., & Atkins, J. H. (2015). Tracheostomy complications as a trigger for an airway rapid response: Analysis and quality improvement considerations. *Otolaryngology—Head & Neck Surgery, 153*(6), 921–926. https://doi.org/10.1177/0194599815612759

Remuzzi, A., & Remuzzi, G. (2020). COVID-19 and Italy: What next? *Lancet*. Advance online publication. https://doi.org/10.1016/S0140-6736(20)30627-9

Rengel, K. F., Hayhurst, C. J., Pandharipande, P. P., & Hughes, C. G. (2019). Long-term cognitive and functional impairments after critical illness. *Anesthesia and Analgesia, 128*(4), 772–780. https://doi.org/10.1213/ANE.0000000000004066

Rockwell, K. L., & Gilroy, A. S. (2020). Incorporating telemedicine as part of COVID-19 outbreak response systems. *The American Journal of Managed Care, 26*(4), 147–148. https://doi.org/10.37765/ajmc.2020.42784

Royal College Speech and Language Therapists. (2020). *RCSLT guidance on personal protection equipment (PPE) and COVID-19*. https://www.rcslt.org/learning/covid-19/rcslt-guidance

Samuelson, K. A. (2011). Adult intensive care patients' perception of endotracheal tube-related discomforts: A prospective evaluation. *Heart Lung, 40*(1), 49–55. https://doi.org/10.1016/j.hrtlng.2009.12.009

Shinn, J. R., Kimura, K. S., Campbell, B. R., Sun Lowery, A., Wootten, C. T., Garrett, C. G., Francis, D. O., Hillel, A. T., Du, L., Casey, J. D., Ely, E. W., & Gelbard, A. (2019). Incidence and outcomes of acute laryngeal injury after prolonged mechanical ventilation. *Critical Care Medicine, 47*(12), 1699–1706. https://doi.org/10.1097/CCM.0000000000004015

Silverman, D. A., Lin, C., Tamaki, A., Puram, S. V., Carrau, R. L., Seim, N. B., Eskander, A., Rocco, J. W., Old, M. O., & Kang, S. Y. (2020). Respiratory and pulmonary complications in head and neck cancer patients: Evidence-based review for the COVID-19 era. *Head & Neck, 42*(6), 1218–1226. https://doi.org/10.1002/hed.26217

Sommer, D. D., Engels, P. T., Weitzel, E. K., Khalili, S., Corsten, M., Tewfik, M. A., Fung, K., Cote, D., Gupta, M., Sne, N., Brown, T. F. E., Paul, J., Kost, K. M., & Witterick, I. J. (2020). Recommendations from the CSO-HNS taskforce on performance of tracheotomy during the COVID-19 pandemic. *Journal of Otolaryngology—Head & Neck Surgery, 49*(1), 23. https://doi.org/10.1186/s40463-020-00414-9

Speech Pathology Australia. (2020a). *Risks associated with speech pathology procedures: Transmission of COVID-19*. https://www.speechpathologyaustralia.org.au/SPAweb/About_us/News/COVID-19_-_Impact_on_members/SPAweb/About_Us/News/COVID-19_and_members.aspx?hkey=e20745b2-d673-49db-ad5f-4191869d264f#covid12

Speech Pathology Australia. (2020b). *Speech Pathology Australia guidance for service delivery, clinical procedures and infection control during COVID-19 pandemic*. https://www.speechpathologyaustralia.org.au/SPAweb/About_us/COVID-19_News_and_Information/COVID-19_-_Guidance_for_Service_Delivery/SPAweb/About_Us/COVID-19/Guidance_for_Service_Delivery.aspx?hkey=fc19a880-e7a8-4246-8631-a474fc43d4ae

Stafford, F. W. (2003). Current indications and complications of tracheoesophageal puncture for voice restoration after laryngectomy. *Current Opinions in Otolaryngology—Head & Neck Surgery, 11*(2), 89–95. https://doi.org/10.1097/00020840-200304000-00005

Standiford, S., Shuman, A., Fessler, D., Brenner, M., & Bradford, C. (2020). Upholding the tripartite mission in times of crisis: Purpose and perseverance amid the COVID-19 pandemic. *Otolaryngology—Head & Neck Surgery*. https://doi.org/10.1177/0194599820922986

Tay, J. K., Khoo, M. L., & Loh, W. S. (2020). Surgical considerations for tracheostomy during the COVID-19 pandemic: Lessons learned from the severe acute respiratory syndrome outbreak. *JAMA Otolaryngology—Head & Neck Surgery*. https://doi.org/10.1001/jamaoto.2020.0764

Thomas, P., Baldwin, C., Bissett, B., Boden, I., Gosselink, R., Granger, C., Hodgson, C., Jones, A., Kho, M., Moses, R., Ntoumenopoulos, G., Parry, S., Patman, S., & van der Lee, L. (2020). Physiotherapy management for COVID-19 in the acute hospital setting: Clinical practice recommendations. *Journal*

of Physiotherapy, 66(2), 73–82. https://doi.org/10.1016/j.jphys.2020.03.011

To, K. K., Tsang, O. T., Leung, W. S., Tam, A. R., Wu, T. C., Lung, D. C., Yip, C. C., Cai, J. P., Chan, J. M., Chik, T. S., Lau, D. P., Choi, C. Y., Chen, L. L., Chan, W. M., Chan, K. H., Ip, J. D., Ng, A. C., Poon, R. W., Luo, C. T., … Yuen, K. Y. (2020). Temporal profiles of viral load in posterior oropharyngeal saliva samples and serum antibody responses during infection by SARS-CoV-2: An observational cohort study. *Lancet. Infectious Diseases, 20,* 565–574. https://doi.org/10.1016/S1473-3099(20)30196-1

Tran, K., Cimon, K., Severn, M., Pessoa-Silva, C. L., & Conly, J. (2012). Aerosol generating procedures and risk of transmission of acute respiratory infections to healthcare workers: A systematic review. *PLOS ONE, 7*(4), e35797. https://doi.org/10.1371/journal.pone.0035797

van Doremalen, N., Bushmaker, T., Morris, D. H., Holbrook, M. G., Gamble, A., Williamson, B. N., Tamin, A., Harcourt, J. L., Thornburg, N. J., Gerber, S. I., Lloyd-Smith, J. O., de Wit, E., & Munster, V. J. (2020). Aerosol and surface stability of SARS-CoV-2 as compared with SARS-CoV-1. *The New England Journal of Medicine, 382,* 1564–1567. https://doi.org/10.1056/NEJMc2004973

Vanhorebeek, I., Latronico, N., & Van den Berghe, G. (2020). ICU-acquired weakness. *Intensive Care Medicine, 46*(4), 637–653. https://doi.org/10.1007/s00134-020-05944-4

Wall, L. R., Ward, E. C., Cartmill, B., & Hill, A. J. (2013). Physiological changes to the swallowing mechanism following (chemo)radiotherapy for head and neck cancer: A systematic review. *Dysphagia, 28*(4), 481–493. https://doi.org/10.1007/s00455-013-9491-8

Wall, L. R., Ward, E. C., Cartmill, B., Hill, A. J., & Porceddu, S. V. (2017). Examining user perceptions of SwallowIT: A pilot study of a new telepractice application for delivering intensive swallowing therapy to head and neck cancer patients. *Journal of Telemedicine and Telecare, 23*(1), 53–59. https://doi.org/10.1177/1357633X15617887

Wang, W., Xu, Y., Gao, R., Lu, R., Han, K., Wu, G., & Tan, W. (2020). Detection of SARS-CoV-2 in different types of clinical specimens. *JAMA, 323*(18), 1843–1844. https://doi.org/10.1001/jama.2020.3786

Wang, Y., Kang, H., Liu, X., & Tong, Z. (2020). Combination of RT-qPCR testing and clinical features for diagnosis of COVID-19 facilitates management of SARS-CoV-2 outbreak. *Journal of Medical Virology*. https://doi.org/10.1002/jmv.25721

Ward, E. C., Bishop, B., Frisby, J., & Stevens, M. (2002). Swallowing outcomes following laryngectomy and pharyngolaryngectomy. *Archives of Otolaryngology—Head & Neck Surgery, 128*(2), 181–186. https://doi.org/10.1001/archotol.128.2.181

Wenaas, A. E., Tran, B., & Ongkasuwan, J. (2016). The progression of thyroid cartilage calcification as it relates to the utilization of laryngeal ultrasound. *The Laryngoscope, 126*(4), 913–917. https://doi.org/10.1002/lary.25582

Wilmskoetter, J., Bonilha, L., Martin-Harris, B., Elm, J. J., Horn, J., & Bonilha, H. S. (2019). Mapping acute lesion locations to physiological swallow impairments after stroke. *Neuroimage Clinical, 22,* 101685. https://doi.org/10.1016/j.nicl.2019.101685

Wilson, N. M., Norton, A., Young, F. P., & Collins, D. W. (2020). Airborne transmission of severe acute respiratory syndrome coronavirus-2 to healthcare workers: A narrative review. *Anaesthesia*. https://doi.org/10.1111/anae.15093

Wolfel, R., Corman, V. M., Guggemos, W., Seilmaier, M., Zange, S., Muller, M. A., Niemeyer, D., Jones, T. C., Vollmar, P., Rothe, C., Hoelscher, M., Bleicker, T., Brunink, S., Schneider, J., Ehmann, R., Zwirglmaier, K., Drosten, C., & Wendtner, C. (2020). Virological assessment of hospitalized patients with COVID-2019. *Nature, 581,* 465–469. https://doi.org/10.1038/s41586-020-2196-x

World Health Organization. (2020). *WHO timeline—COVID-19*. https://www.who.int/news-room/detail/27-04-2020-who-timeline—covid-19

Xiang, Y. T., Jin, Y., Wang, Y., Zhang, Q., Zhang, L., & Cheung, T. (2020). Tribute to health workers in China: A group of respectable population during the outbreak of the COVID-19. *International Journal of Biological Sciences, 16*(10), 1739–1740. https://doi.org/10.7150/ijbs.45135

Yamamoto, N., Ishii, A., Miyashita, T., & Goto, T. (2020). Airway management strategy for accidental tracheal extubation in the prone position: A simulation study. *Journal of Clinical Anesthesia, 63,* 109786. https://doi.org/10.1016/j.jclinane.2020.109786

Yu, X., & Yang, R. (2020). COVID-19 transmission through asymptomatic carriers is a challenge to containment. *Influenza and Other Respiriratory Viruses*. Advance online publication. https://doi.org/10.1111/irv.12743

Zaga, C. J., Berney, S., & Vogel, A. P. (2019). The feasibility, utility, and safety of communication interventions with mechanically ventilated intensive care unit patients: A systematic review. *American Journal of Speech-Language Pathology, 28*(3), 1335–1355. https://doi.org/10.1044/2019_AJSLP-19-0001

Zhang, W. Q., Lambert, E. M., & Ongkasuwan, J. (2020). Point of care, clinician-performed laryngeal ultrasound and pediatric vocal fold movement impairment. *International Journal of Pediatric Otorhinolaryngology, 129,* 109773. https://doi.org/10.1016/j.ijporl.2019.109773