



## Tracheostomy care: Clinical practice patterns of pediatric otolaryngologists-head and neck surgeons in a publicly funded (Canadian) health care system

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### ABSTRACT

**Objectives:** To investigate variability in pediatric tracheostomy tube care practice patterns and access to resources across Canada.

**Methods:** Canadian pediatric otolaryngologists-head & neck surgeons reported their own practice patterns for children with chronic tracheostomy tubes using a web-based, 29-item multiple choice and short answer questionnaire. Domains investigated included tracheostomy team membership, inpatient care practices, caregiver education, homecare resources, speech and communication, and completeness of emergency tracheostomy kits. **Results:** The response rate was 86.4% (38/44). Most respondents care for children with tracheostomy tubes as part of an inter-professional team (25/36; 69.4%) and arrange routine follow-up with a speech and language pathologist (22/36; 61.1%). However, the majority (23/34; 67.6%) of respondents do not formally reassess caregiver competencies (i.e. cardiopulmonary resuscitation, emergency tracheostomy care). Notably, respondents were also unsure 36.1% (13/36) of how frequently Shiley tracheostomy tubes should be washed and reused with the majority (15/36; 41.7%) reporting never. Most (15/36; 41.7%) respondents were also unsure of reuse recommendations for Bivona tracheostomy tubes. One third (12/36; 33.3%) of respondents were unsure about government-funded homecare services being provided in their community to children with tracheostomy tubes.

**Conclusion:** There is much variability in pediatric tracheostomy tube care practice patterns across Canada. Results suggest that an evidence-based Canadian clinical practice guideline may help to streamline care provided to Canadian children with tracheostomy tubes.

### 1. Introduction

A tracheostomy is a surgically created passage through the neck into the trachea, performed to bypass an upper airway obstruction, facilitate long-term mechanical ventilation and/or allow for pulmonary clearance [1]. Children with tracheostomies are at risk for recurrent hospitalization due to tracheostomy-related complications, such as respiratory infections [2,3]. The American College of Surgeons National Surgical Quality Improvement Pediatric Program demonstrated that the highest contribution to morbidity in otolaryngology is seen in children younger than two years of age undergoing tracheostomy [4]. Clearly, there is a need to identify and optimize the care of children undergoing tracheostomy.

A multidisciplinary team approach that applies consistent care

practices appears to be the best way to manage the many complexities seen in children with tracheostomy tubes [5–7]. The American Association of Otolaryngology-Head & Neck Surgery (AAOHNHNS) guideline for tracheostomy tube care highlights that efforts should be made to minimize variations in practice when caring for patients with tracheostomy tubes with the goal of minimizing tracheostomy tube related complications, prolonged hospitalizations and death [8].

Tracheostomy tube care practices in a publicly funded healthcare system have not yet been investigated. Institution of standardized practices at a national level is faced by a number of challenges. Utilizing standard care guidelines in a publicly funded setting may prove even more challenging based on resource limitations. However, it also presents a unique opportunity to streamline national practices given there are still variations in care even amongst a relatively small group of

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involved healthcare professionals.

The aim of our study is to describe the clinical practice patterns of Canadian pediatric otolaryngologists regarding chronic tracheostomy tube care and to examine community resource variability (speech language, homecare professionals, etc.) in Canada with the goal of working towards standardizing care across the country and improving pediatric tracheostomy tube related complications and overall outcomes.

## 2. Methods

A cross-sectional survey of pediatric otolaryngologists-head and neck surgeons was conducted from January 1 to May 31, 2017 (Supplement A). This study utilizes a similar model to survey based study of physicians prepared by Senders et al [9]. This study was approved by The Research Ethics Boards at the Hospital for Sick Children (REB #1000051363).

An online external REDCap (Research Electronic Data Capture; Vanderbilt University, Nashville) survey regarding current practices for caring for children with tracheostomy tubes was developed by the authors who have expertise in pediatric otolaryngology and long-term ventilation. The 29-item survey consisted of multiple choice and short answer questions. Investigated domains included tracheostomy team membership, inpatient care practices, caregiver education, homecare resources, speech and communication, as well as ongoing assessments of emergency tracheostomy kits. The survey was emailed to Canadian pediatric otolaryngologists using addresses obtained from hospital websites, phone communication with administrative personnel and the authors' social networks. The data collection tool allowed only a single response per participant via an individualized survey link and all participation was voluntary and anonymous. Each potential study participant received a first email reminder 2 weeks after the initial survey, a second reminder at 12 weeks and a third reminder at 14 weeks. Descriptive statistics were used to summarize study results. Microsoft excel (Microsoft, Washington) was used for quantitative and qualitative data analysis. Thirty-eight of 44 (86.4%) pediatric otolaryngologists-head and neck surgeons responded. Partial responses were identified for 9 survey items and all surveys were included in data analysis.

## 3. Results

### 3.1. Respondent demographics

All respondents identified themselves as working in an academic hospital. Respondents practiced in 6 of 10 provinces, and 1 of 3 territories. The geographic representation of respondents is summarized in Table 1. The majority (40%) had been in practice 11–20 years, 29% between 5 and 10 years, 18% greater than 21 years, and 13% less than 5 years.

### 3.2. Tracheostomy team membership

The majority of respondents (25/36) had a multidisciplinary inpatient tracheostomy team at their institution, all of which had a

**Table 1**  
Geographic representation of the survey respondents.

Province/Territory	Number of survey respondents (n = 38)
Ontario	15 (39.5%)
Quebec	7 (18.4%)
Alberta	6 (15.8%)
British Columbia	5 (13.2%)
Nova Scotia	3 (7.9%)
Manitoba	2 (5.3%)
Nunavut	1 (2.6%)

\*No respondents from Provinces/Territories not listed.

**Table 2**  
Tracheostomy team membership of inpatient and outpatient tracheostomy teams across Canada as per survey respondents.

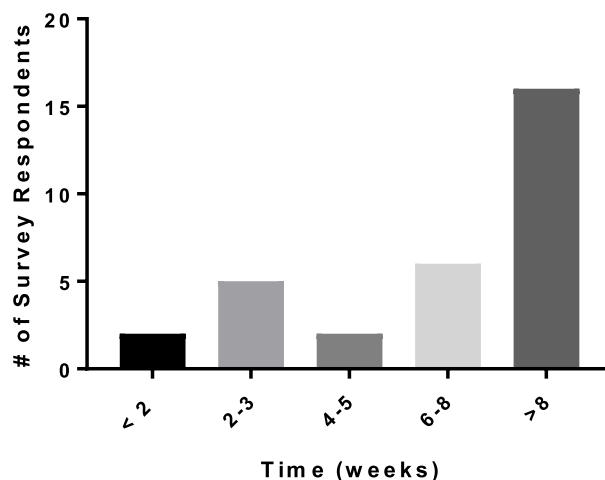
Inter-professional designation	Survey Respondents	
	Inpatient team membership (n = 25)	Outpatient team membership (n = 24)
Otolaryngologist	25 (100%)	23 (95.8%)
Pediatrician	11 (44.0%)	4 (16.7%)
Neonatologist	6 (24.0%)	0 (0%)
Respirologist	19 (76.0%)	19 (79.2%)
Intensive Care Physician	9 (36.0%)	3 (12.5%)
Respiratory Therapist	18 (72.0%)	15 (62.5%)
Nurse Practitioner	13 (52.0%)	12 (50.0%)
Registered Nurse	14 (56.0%)	14 (58.3%)
Social Worker	9 (36.0%)	8 (33.3%)
Speech Therapist	9 (36.0%)	8 (33.3%)
Pharmacist	1 (4.0%)	1 (4.2%)
Dietician	4 (16.0%)	3 (12.5%)
Other: ethicist, geneticist, palliative care/assist team, home care coordinator	3 (12.0%)	2 (8.3%)

pediatric otolaryngologist-head and neck surgeon as a member (Table 2). Most (24/37; 64.8%) had a dedicated outpatient tracheostomy clinic at their institution.

### 3.3. Tracheostomy care practices

Most (22/37; 59.5%) pediatric otolaryngologists – head and neck surgeons reported an average length of stay for non-ventilated patients from tracheostomy tube insertion to discharge home lasting greater than 6 weeks (Fig. 1). Six (6/37; 16.2%) respondents were unsure of the average length of stay at their institution. Most (32/37; 86.4%) patients with new tracheostomy tubes do not transition to rehabilitation facilities prior to discharge home.

Shiley (Medtronic, Minneapolis, USA) and Bivona (Smiths Medical, Minneapolis, USA) tracheostomy tubes were used by 100% (37/37) and 97.3% (36/37) of respondents, respectively. The majority (21/37; 56.7%) primarily used Shiley tubes and the rest primarily used Bivona tubes (17/37; 45.9%). A small subset of respondents (2/37; 5.4%) reported also using custom designed tracheostomy tubes made by TRACOE (TRACOE medical, Neider-Olm, Germany) or Portex (Smiths Medical, Minneapolis, USA). Cuffed tracheostomy tubes were most commonly used in children requiring long-term ventilation (33/36; 91.7%), who had chronic aspiration (8/36; 22.2%) or a consistent leak



**Fig. 1.** Average length of stay from tracheostomy to discharge home for non-ventilated patients as reported by survey respondents.

**Table 3**  
Summary of trends in home care surveillance and monitoring.

	Number of survey respondents
Number of required trained caregivers prior to discharge	n = 34
1	5 (14.7%)
2	23 (67.6%)
3	4 (11.8%)
≥ 4	2 (5.9%)
Reassessment of skills after discharge home, n (%)	n = 34
Yes	11 (32.4%)
No	23 (67.6%)
Home monitoring recommendations for patients with tracheostomies	n = 36
Recommendation for continuous eyes on care, n (%)	22 (61.1%)
Prescription of oximeters for patients, n (%)	22 (61.1%)
Other (depends on child, transition from continuous monitoring to competent caregiver 'near-by')	2 (5.6%)
Unsure/Do not know	8 (22.2%)
Homecare support funded for children with tracheostomies	n = 36
Registered nurse	16 (44.4%)
Registered practical nurse	13 (36.1%)
Personal support worker	5 (13.9%)
Other (comments included respiratory therapy support, trach related medical supplies)	2 (5.6%)
Unsure/Do not know	12 (33.3%)

only in the setting of high ventilation pressures (5/37; 13.5%). One respondent reported never having used a cuffed tracheostomy tube for a pediatric patient.

### 3.4. Tracheostomy caregiver education and training

The lead educators for tracheostomy tube training of caregivers were most commonly a respiratory therapist (16/37; 43.2%), registered nurse (15/37; 40.5%) or nurse practitioner (13/37, 35.1%). Locations for tracheostomy tube training and education for caregivers included inpatient wards (30/37; 81%), pediatric intensive care unit (25/37; 67.5%), neonatal intensive care unit (22/37; 59.5%) and step-down unit (17/37; 45.9%). Most respondents (24/34; 70.5%) also reported their institution used simulation models as a component of teaching.

The majority of respondents indicated that their institution (27/32; 84.4%) requires a minimum of two family caregivers be trained to care for a child with a tracheostomy tube. Most respondents (23/34; 67.6%) said there is no reassessment of initial tracheostomy competencies following discharge and 22.2% (8/36) were not aware of home monitoring recommendations for these patients. Funded homecare support staff for children with tracheostomies are outlined in Table 3.

Most respondents recommended that parents change the tracheostomy tube once per month for Shiley (18/37; 48.6%) or Bivona (20/37; 54.1%) tubes that do not have an inner cannula. Almost one half of respondents felt that Shiley tracheostomy tubes never need to be washed and reused (15/36; 41.7%) or they were unsure (13/36; 36.1%). Similarly, for Bivona tracheostomy tubes, the majority of respondents were unsure how often they would recommend washing and reusing the device (15/36; 41.7%).

### 3.5. Speech and communication

Most otolaryngologists – head and neck surgeons (19/37; 51.4%) indicated that speech language pathologist (SLP) referrals are routine at their institution during the initial post-operative tracheostomy admission. However, 62.1% (23/37) of these said that speaking valves were not routinely trialed in hospital during the initial admission but rather SLP follow up was arranged after discharge with most being in the community (13/20; 65.0%). Two respondents whose patients routinely

**Table 4**  
Frequency of pediatric tracheostomy kit inspection by healthcare provider.

Frequency of tracheostomy kit inspection by healthcare provider	Number of respondents (n = 32)
Once per month	6 (18.8%)
Once per 4 months	10 (31.3%)
Once per 6 months	5 (15.6%)
Once per 12 months	3 (9.4%)
Never	1 (3.1%)
Other (free text responses: 'depends on child', 'home care services responsibility')	7 (21.9%)

have outpatient SLP follow up did not indicate if these patients were routinely assessed by SLP for a speaking valve.

### 3.6. Emergency tracheostomy kit

Two thirds of respondents (21/32; 65.6%) said that a healthcare practitioner inspects each child's emergency tracheostomy kit at least once every 6 months; however, some inspect once per year or never (Table 4). Two said that it depends on the child and one believed home care was responsible for this assessment.

## 4. Discussion

This study summarizes current tracheostomy clinical practice patterns of pediatric otolaryngologists – head & neck surgeons in a public funded, Canadian health care system and highlights commonalities and discrepancies. These deficient areas of care have the potential to be optimized to improve the care of children with tracheostomies through standard care practices.

The majority of otolaryngologists surveyed reported their institution utilizes both inpatient and outpatient 'tracheostomy' teams to provide comprehensive care and assist caregivers. This is supported by the recent American Academy of Otolaryngology Head & Neck Surgery's (AAOHNS) clinical consensus statement on tracheostomy care [8]. It is only with relatively recent advancements in home ventilation technology that children with tracheostomies are able to be discharged home. This shift of management to an outpatient setting emphasizes the importance of adopting a multidisciplinary approach for the care of these children to ensure the continuity of care for the multitude of tracheostomy issues they may encounter [8,10,11].

All respondents acknowledged the importance of a structured tracheostomy competency training program for family caregivers prior to the child's initial discharge home after tracheostomy insertion. This also aligns with the AAOHNS tracheostomy care clinical consensus statement [8]. Tracheostomy teaching routinely occurs, as per our study group, on in-patient wards or in the pediatric ICU and is led by registered nurses, nurse practitioners, or respiratory therapists. Most respondents reported that a minimum of two caregivers are required to be competent in tracheostomy care prior to safe discharge, which reflects the American Thoracic Society (ATS) consensus statement for caring for children with tracheostomy [10]. However, 68% of respondents reported that following initial training there was no formal reassessment of caregivers' tracheostomy competencies. There are also variations in how frequently emergency tracheostomy kits are reviewed to ensure caregivers are fully equipped in an emergency situation. The literature suggests the prevalence of tracheostomy tube obstruction and/or accidental decannulation in children ranges from 11 to 20% [11,12]. A recent study by Amin et al., found 30 consecutive pediatric patients with tracheostomies assessed at a tertiary otolaryngology clinic did not have complete emergency tracheostomy kits [13]. A complete emergency tracheostomy kit is critical in managing an airway emergency and routine reassessment of these kits by healthcare team members may help ensure they are fully stocked. We suggest that emergency

tracheostomy kits should be reassessed at regular intervals along with caregiver skills, given the potential devastating impact of poor lack of preparedness or caregiver tracheostomy knowledge.

Despite respondents agreeing that both Shiley and Bovina tracheostomies should be changed once per month, there was considerable variability regarding recommendations on how frequently these tubes should be washed and reused. Twenty-three respondents (41.7%) reported never recommending a Shiley tube be rewashed and reused but 13 respondents (36.1%) were unsure. Similarly, 41.7% of respondents reported being unsure how often they would recommend a Bivona tracheostomy tube to be reused. As per manufacturer recommendations, a new Shiley tracheostomy tubes should be used every month and a new pediatric Bivona tube should be changed after 5 tracheostomy reuses.

Homecare resources are vital to a caregiver's ability to care for their child with tracheostomy [8,14]. The majority of respondents were able to use government funding for registered nursing or register practical nurse. However, 33.3% of respondents were unsure of what resources were available. Assistance when caring for a child with a tracheostomy in a home setting may decrease caregiver fatigue [10,14–16]. There were also variations in home monitoring recommendations across respondents with 61% recommending continuous monitoring of these patients as well as recommending the use of home oxygen monitoring. Eight respondents were not familiar with the home care recommendations given to caregivers at their institution. The ATS guideline for pediatric chronic home invasive ventilation recommend an awake, alert and tracheostomy and ventilation trained caregiver monitors children with chronic ventilation at all times and uses a pulse oximeter when sleeping [10]. Although these recommendations are specific only to a subset of pediatric patients requiring tracheostomy our survey demonstrates a variable degree of understanding of home monitoring requirements.

In young children, the impact of a tracheostomy on communication may be significant given that they are often unable to communicate via alternative modes such as writing or mouthing phrases. The resultant aphonia may occur at a prime developmental period for language and speech acquisition and the healthcare team should focus on optimizing phonation as much as is safely possible. The timing of this initial assessment is not indicated in the AAOHNS consensus though it recommends a treatment plan be developed to optimize communication [8]. We propose this communication assessment should occur based on each individual patient's appropriateness as reflected by the collected heterogeneous responses to timing of first SLP assessment. This is critical in ensuring communication for the child with tracheostomy during this key learning period for language.

This study is retrospective and may be limited by recall bias. Results may also be influenced by selection bias (though limited by the high response rate) and 'best estimate' bias. However, given the group of pediatric otolaryngologists in Canada is relatively small, this study hopefully provides a fairly comprehensive assessment of practices across Canada. In this study, only pediatric Otolaryngologists in academic centres responded to our survey. This most likely reflects the nature of our public system with the majority of children in need of tracheostomy being referred to academic centres. Useful information could be gained from understanding how children with tracheostomies are supported in non-academic centres and future work will be focused in this area.

## 5. Conclusions

Pediatric otolaryngologists in Canada have multidisciplinary teams

to care for children with tracheostomies. However, they also have variable practices with respect to caregiver education, emergency tracheostomy kit re-assessment, and long-term assessment of caregiver skills and there is a subset of pediatric otolaryngologists who are not familiar with community resources available to their patients. This work identifies areas of considerable variation in care practices amongst an already small group of experts working in a publicly funded system. It emphasizes the need for the creation of clinical practice guidelines focused on pediatric tracheostomy care to ensure homogeneity in the quality of care provided and address the best practice recommendations in hospital and even more so at home.

## Conflicts of interest

This research did not receive any specific grant from funding agencies in the public, commercial, or non-profit sectors.

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