

Global Tracheostomy Collaborative: The Future of Quality Improvement Strategies

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Abstract Patients who undergo tracheostomy are an extremely heterogeneous, often critically ill group, who can often experience significant morbidity and mortality. The challenge of measuring and improving the quality of care for this diverse patient population has remained. There have been several publications within the last year highlighting advances in both quality monitoring and risk prevention strategies in tracheostomy care. This article reviews those recent key developments and introduces a model to facilitate the development and dissemination of good-practice in tracheostomy management. The majority of literature focuses on single-institution interventions with a paucity of widely generalizable evidence available. Other fields of medicine have faced similar challenges and have

used quality improvement collaboratives to good effect. This article describes the innovative model for improving tracheostomy related outcomes called the Global Tracheostomy Collaborative (GTC). The GTC aims to provide the foundation necessary to translate data and knowledge into local quality change by opening lines of communication, disseminating high quality information and sharing best practices, supported by clinical data. A quality improvement collaborative may provide a new tool to link exemplar institutions, share clinical data, conduct research, develop metrics and—ultimately—improve the care and quality of life for all tracheostomy patients.

Keywords Collaborative · Tracheostomy · Outcomes · Quality improvement

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Introduction

Over the past several decades, there have been substantial advances in tracheostomy care. Despite improvements in patient selection, insertion techniques and postoperative monitoring, there remains significant morbidity and mortality associated with tracheostomy placement and management. Between 1 and 7 % of patients suffer an adverse event, and the majority of these occur after the first postoperative week [1, 2]. Although deaths directly attributable to tracheostomy-related adverse events occur relatively infrequently, between 20 and 30 % of patients do not survive to hospital discharge, with the majority of these patients succumbing to their underlying illness [1–5, 6•]. A significant proportion of negative tracheostomy-related outcomes are preventable. Many factors that contribute to adverse events can be identified and addressed through the implementation of systematic quality improvement practices [2, 7]. This article describes some of the recent advances in both quality monitoring and risk prevention strategies in tracheostomy care. This is followed by an overview of quality improvement collaboratives, highlighting an innovative model for improving tracheostomy-related outcomes called the Global Tracheostomy Collaborative.

Quality Advances in Tracheostomy Care

Targeted prevention interventions—ranging from identifying technical alternatives to implementing new postoperative care management models—have demonstrated the potential to improve clinical outcomes in both adult and pediatric patients undergoing tracheostomy. For instance, rigorous evaluation of tracheostomy techniques demonstrated percutaneous dilatational tracheostomy (PDT) as an effective alternative to ‘open’ tracheostomy in certain patient subsets. PDT has been shown to be a safe and effective procedure in critically ill patients [8, 9]. Additionally, the literature has demonstrated the positive impact of quality improvement interventions that standardize clinical environments through consistent implementation of evidence-based practices. Examples of these include clinical care bundles and best practice guidelines. These evidence-based interventions improve the process of care, and several studies have shown remarkable reductions in tracheostomy-site pressure ulcers, tracheostomy-associated pneumonia and the frequency of clinical adverse events [10–12].

Multidisciplinary team-based care in tracheostomy aftercare has become an innovative prevention tool that is making advances in the clinical setting. Dedicated tracheostomy multidisciplinary teams—consisting of surgeons,

intensive care physicians, nurses, speech pathologists, physiotherapists and respiratory therapists—are becoming more common in adult and pediatric hospitals. Members of a dedicated tracheostomy care team coordinate and routinely assess patient progress in readiness for tube decannulation. The team ultimately ensures continuity-of-care and appropriate support for the patient. It is speculated that dedicated multidisciplinary teams enhance communication between individuals involved in the care, thereby improving shared decision-making and consistency of care [13].

These structured multidisciplinary clinical tracheostomy teams also have shown documented improvements in several single-institution studies worldwide. Tobin and Santamaria [14] in Australia demonstrated that intensive care physician-led tracheostomy teams were associated with shorter cannulation times and hospitalizations. Cameron et al. [15] reported the Tracheostomy Review and Management Service (TRAMS) program, also in Australia. This described the implementation of a multidisciplinary consultation program that was associated with more timely discharge, earlier decannulation and more rapid speaking valve usage. There was also an overall cost saving for patients undergoing tracheostomy in the context of spinal cord injury. Studies in Canada [16], the United Kingdom [17] and the United States [18] have all shown similar improvements in clinical outcomes following implementation of dedicated multidisciplinary care teams [16–18].

Although many studies report successful institutional models, statistically validated quality improvement strategies in tracheostomy care remain limited. The majority of the literature focuses on quality improvement in tracheostomy care by means of interventions in single institutions. Unfortunately, there remains a paucity of widely generalizable evidence. A recent meta-analysis conducted by Speed and Harding [19•] concluded that only low quality evidence exists to demonstrate that multidisciplinary teams contributed to decreased cannulation time or increase speaking valve usage, and there was insufficient evidence to comment on effects on hospitalization or intensive care unit lengths of stay.

The Quality Lag in Tracheostomy Care

Despite advances in care over the past decades, there also remains a quality lag in tracheostomy care when compared to other fields of medicine. The quality lag exists for several important reasons. Firstly, relatively few multi-center trials have been conducted in tracheostomy care, making generalizability for care delivery limited. Randomized, double-blinded, multicenter trials, although the gold standard of research, are costly, time consuming, and challenging in tracheostomy care. The logistics associated with

conducting randomized trials of team-based care, using the hospital as the unit of randomization, are extraordinarily challenging.

Secondly, there remain few validated measures of quality and outcomes for tracheostomy care. Measures of outcomes used to evaluate clinical efficacy include mortality, length of stay and hospital readmissions rate. However, these are all difficult to interpret because the underlying clinical disease states of tracheostomy patients are remarkably complex and heterogeneous.

Thirdly, truly assessing the impact of interventions for tracheostomy patients is difficult due to clinical variability. Many patients receiving tracheostomy tubes are critically ill and their clinical course and outcome is likely to be driven primarily by their underlying disease state. Furthermore, as evident by the TracMan study published in 2013 in the *Journal of the American Medical Association*, the ability of clinicians to predict patients' need for extended ventilator support is limited, which clouds the optimal timing of tracheostomy insertion [20]. In addition to these sources of variability, tracheostomy tube placement is indicated in both chronic and acute illness. The extreme clinical heterogeneity in tandem with the broad range of indications for the procedure makes case-mix adjustment—the backbone of comparative assessment—challenging.

Fourthly, there is significant inter-institutional variability regarding the method of tube insertion, location of procedure (i.e. bedside, intensive care unit, operating suite), and service line involved in the surgery (i.e. adult, pediatric, mixed). In a survey of eight academic institutions in the United States, two-thirds of tracheostomies were performed by otolaryngologists, while the other one-third was performed by other surgical specialists. In addition, the surgical technique (i.e. Bjork flap, cartilage resection, etc.) varied considerably depending on the specialty of the surgeon performing the procedure [1].

Fifthly, until recently, few published national and international clinical practice guidelines existed relating to tracheostomy care. Although the American Academy of Otolaryngology—Head and Neck Surgery (AAO-NHS) issued a Clinical Consensus Statement on Tracheostomy Care in 2012, prior to this there was little consensus about best practices [6••].

Finally, the relative infrequency of tracheostomy procedures makes outcome evaluation difficult, particularly in the setting of tremendous clinical heterogeneity. This issue is chiefly applicable to pediatric tracheostomy care, where, even in large centers, the annual volume may be less than 100 tracheostomy tube insertions per year. Such sample sizes, combined with clinical and process variability, make it difficult to detect statistically significant change in a single institution.

For all of these reasons, there are many obstacles to rigorous assessment of quality in tracheostomy care when applying traditional research methodology.

Quality Improvement Collaboratives: What are They?

Other fields of medicine have faced similar challenges in measuring and tracking quality, and many have used alternative methods for measuring outcomes and quality improvement. Specifically, many fields of adult and pediatric medicine have, in recent years, adopted quality improvement collaboratives.

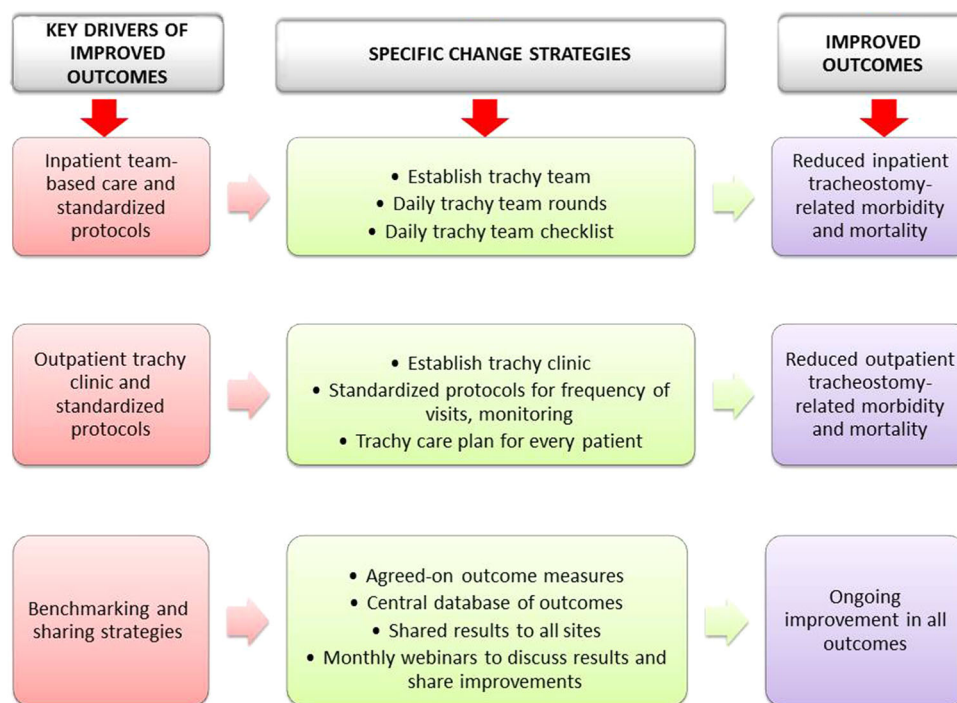
A quality improvement collaborative is a group of institutions, hospitals, clinics, and/or clinicians who work together through shared methodology and shared purpose. Their collective remit is to identify specific practices and drive positive change through data analysis and shared learning. Centered in continuous quality improvement theory, healthcare quality collaboratives also help clinicians develop the tools necessary to launch sustainable quality initiatives. Healthcare quality improvement collaboratives therefore serve as a catalyst for clinical innovation by helping members identify key clinical problem areas; collect and analyze data; identify positive or negative variance; identify time-related trends; create and sustain open communication channels with multiple stakeholders; promote group learning; elicit expert opinion; and help support member-led quality improvement cycles [21•].

Rising Popularity of Quality Improvement Collaboratives

This type of collaborative model focused on quality improvement has grown popular in recent years because of its innovative strategy and successful results. Accordingly, quality improvement collaboratives have been used to address a myriad of clinical problems, including maternity and perinatal care, asthma, and adult congestive heart failure. Aside from aiming for world-class care that is safe and efficient, hospitals may participate to meet less measurable parameters, such as achieving regulatory and accreditation standards, optimizing market share, enhancing revenue, and improving the organizational culture of patient safety and quality at the single institution level [22].

While the quality improvement collaborative model is still fairly new, some collaboratives have been able to demonstrate utility in changing the clinical environment. One prominent example of a successful quality improvement collaborative is the Vermont Oxford Network (VON), a collaboration of neonatal intensive care units formed in 1988 to help clinicians identify clinical practice and

Fig. 1 Strategy diagram: global Tracheostomy Collaborative



outcome variation (<http://www.vtoxford.org>) [23]. The VON enabled member units to identify high value clinical performance characteristics, develop and implement large scale quality improvement initiatives, and conduct randomized control research trials; ultimately making significant improvements in clinical quality [23–25].

What Makes a Quality Improvement Collaborative Work?

Quality improvement collaboratives are complex and diverse in both application and intention. Systematic evaluations of published quality improvement collaboratives suggest positive, albeit limited, results. It is not yet well understood exactly what constructs predict success in a collaborative [26•]. Milbank Quarterly recently published a meta-analysis by Nadeem et al. [21•] evaluating the factors underlying a successful healthcare quality improvement collaborative. The researchers concluded that there are 14 key components necessary for a quality improvement collaboratives' successful functioning. The components most commonly cited were in-person learning and training sessions, multidisciplinary quality improvement initiatives, data collection and analysis, and infrastructure for continuous quality improvement implementation [21•]. These functions are vital to spurring clinical change and critical thinking in medical practice.

Health care quality improvement collaboratives are likely to play an important role in the future of quality

improvement. They can function in circumstances where the traditional multiple-site randomized clinical trial is infeasible, impractical, or cost prohibitive. They are also a cost-effective way of rapidly disseminating improvement strategies, and engaging in shared learning across institutions around the world.

The Global Tracheostomy Collaborative: The Interface of Quality Improvement Collaboratives and Tracheostomy Care

Based on the successes of other quality improvement collaborative models and to help address the challenges faced in improving tracheostomy care, the Global Tracheostomy Collaborative (GTC) was formed in 2012 as the first non-profit, healthcare quality improvement collaborative focused on tracheostomy care. This organization aims to be the foundation for improving outcomes on a population level through identification and proliferation of shared best practices, rigorous evaluation of data for positive or negative variance, and collaborative learning for its members (Fig. 1). Upon launching, the GTC also charted its mission statement—to improve the quality of care and quality of life for every individual who has a temporary or long-term tracheostomy (www.globaltrach.org).

The GTC aims to improve quality of care and outcomes by striving to accomplish four cardinal goals, which include: (1) rapidly disseminating evidence-based protocols and checklists from successful hospitals; (2) creating a

Table 1 Key clinical outcome measure: Global Tracheostomy Collaborative

Clinical outcome measure	Description of clinical quality questions
1. Indication for tracheostomy	What were the leading indications for tracheostomy?
2. Adverse events	What % of patients experienced an adverse event following tracheostomy? How many days following tracheostomy placements did the majority of adverse events occur? What were the most frequent adverse events?
3. Intensive care unit length of stay	What was the average intensive care unit length of stay following tracheostomy?
4a. Duration of mechanical ventilation	What was the average duration of mechanical ventilation following tracheostomy?
4b. Duration of tracheostomy tube	What was the average duration of tracheostomy tube?
5. Total hospital length of stay	What was the average hospitalization following a tracheostomy?
6. Discharge disposition	To which care setting were a majority of patients discharged home following tracheostomy placement?
7. Mortality rate	What % of patients survived to hospital discharge following tracheostomy?

large network of hospitals to conduct data sharing for the purposes of quality improvement; (3) developing validated outcome-based metrics to allow hospitals to benchmark their performance and track improvement, while allowing for robust statistical analysis of clinical performance; and, (4) moving the collective needle on key measures of outcomes. The following is a discussion of each of these four objectives.

Rapidly Disseminate Evidence-Based Protocols

A common challenge encountered in promoting rapid clinical change in all fields of medicine is the time lag between research discovery and clinical implementation [27]. The GTC aims to help support the proliferation of information by becoming a central repository of evidence-based protocols developed by tracheostomy care experts. Through regular communication materials and meetings, member institutions can share interventions they have introduced at their hospitals, and discuss both the successes and failures of those interventions. As has been shown to be successful in the literature on other quality improvement collaboratives, the GTC also aims to provide a platform for engaging in discussions around identified key quality issues, using those discussions more practically for continued learning and data-driven action.

Create a Network of Hospitals to Conduct Data Sharing

The GTC aims to support member institutions in facilitating meaningful and measurable clinical outcome changes. To do so, the GTC has created and pilot tested the first database for collecting tracheostomy data regarding adult and pediatric patients around the world. This provides member institutions with the ability to enter data over time,

yielding a rich database of information useful not only for quality improvement measurements, but also for broader clinical research purposes.

In creating this database, the GTC utilized research electronic data capture (REDCap) technology, a secure-web based data entry software, coupled with standardized GTC-specific data definitions (<http://www.project-redcap.org/>) [28]. This technology enables GTC member hospitals to enter retrospective clinical outcomes data for each tracheostomy insertion at their institution, and share data points devoid of protected health information with the collaborative. The preliminary GTC database will collect a total of 60 data elements, including demographics (i.e. age, gender, chronic diseases status, ventilation status prior to tracheostomy) and key outcome variables (see Table 1), which will be reported to the group in anonymity on a regular basis.

In its initial phases, the GTC database will collect data exclusively on the key inpatient measures identified for the admission during which the tracheostomy procedure occurred. Future directions include assessment for outpatient encounters and hospital readmissions.

Develop Validated Outcome-Based Metrics

Developing validated outcome-based metrics is both the arduous challenge and vast potential of a centralized, standardized, multi-institution quality database. As discussed previously, there are few, if any, validated quality measures of outcome in tracheostomy care. In addition, there is little consensus on appropriate risk adjustment models for adult and pediatric tracheostomy patients.

In its current form, the GTC database aims to gather a large volume of clinical data over time, for the purpose of rigorous statistical analysis. The data must be analyzed in such a way that accurately adjusts for the inherent

heterogeneity of patients, while also ensuring that the metrics precisely reflect the introduction of new clinical protocols. This process will be lengthy; however, the ability to generate, use, and analyze a large scale, longitudinal descriptive database of clinical outcomes for the first time in tracheostomy care provides vast potential not only for identifying, but also for driving best practices, as well as collectively moving clinical care towards progress on key measures of outcomes.

Moving the Collective Needle on Key Outcomes Measures

To achieve the ultimate goal of improving care (or “moving the needle”) and quality of life for every individual with a tracheostomy will require a commitment to quality. Tracking of interventions and their effects over time will hopefully assist in organizational learning and changes in clinical outcomes. The GTC hopes to provide the foundation necessary to translate data and knowledge into local quality change by opening lines of communication, disseminating high quality information and sharing best practices, supported by clinical data.

Quality Improvement in Tracheostomy Care—In Conclusion

Patients who undergo tracheostomy are an extremely heterogeneous, often critically ill and vulnerable group, who often experience significant morbidity and mortality. Despite great advances in tracheostomy care over the past decades, there remains much work to be done to address the challenge of measuring and improving quality for this diverse patient population. A quality improvement collaborative may provide a new tool to link exemplar institutions, share clinical data, conduct research, develop metrics and—ultimately—improve the care and quality of life for all tracheostomy patients.

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Compliance with Ethics Guidelines

Conflict of Interest David Roberson has received payment for expert testimony from Atlee Hall and has received reimbursement for travel/accommodation expenses from the American Academy ORL

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Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by the authors.

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- Of major importance

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