Abstract of dissertation entitled

An Evidence-based Guideline on the Management of Tracheostomy

Decannulation in Critically Ill Patients

Submitted by

Chan Lok Man

For the degree of Master of Nursing

at the University of Hong Kong in July 2015

Research indicated that the number of clients underwent surgical tracheostomy has been increasing gradually. However, different complications and clinical emergencies would also be resulted. Recent literature has revealed that early decannulation or weaning of tracheostomy with proper progression and multidisciplinary collaboration should be promoted, which could shorten the length of stay (LOS) and decannulation time. However, there is no such standardized guideline for tracheostomy decannulation in the hospitals in Hong Kong.

In view of this, this dissertation aims to evaluate the current evidence on the efficacy of tracheostomy decannulation through multidisciplinary approach, to formulate an evidence-based management, as well as to assess its implementation
potential and to develop implementation strategies and evaluation plan that fit for the local setting of a neurosurgical ward of a teaching hospital in Hong Kong.

Three electronic databases, Pubmed, Medline and CINAHL were included in the systematic search performed, 67 studies were identified and 8 of the studies met the inclusion criteria of this dissertation. Data were extracted and critical appraisal was done by using the grading method of Scottish Intercollegiate Guidelines Network (SIGN, 2014). Statistically significant results were shown in reduction of decannulation time and LOS by using multidisciplinary approach in tracheostomy management, and no major adverse patient outcome was shown during the approach.

The target setting for the approach would be a Neurosurgical (NS) ward in a teaching hospital in Hong Kong. Convenience sampling would be adopted to recruit clients for the proposed practice. In the implementation plan, a 12-month programme was designed to cover several aspects, including communication plan, staff training, pilot testing and evaluation plan. The communication plan was used to identify the stakeholders and gain supports from them. Staff training was used to allow the knowledge and skills were provided to colleagues to ensure the standard of care. Pilot testing was used to test the logistic and reveal any potential problem, so adjustments could be made prior to the implementation of the proposed practice in the unit. In the evaluation plan, effectiveness of the practice will be evaluated in three main areas,
including patient outcomes, healthcare provider outcomes and system outcomes. For major focus, the patient outcomes, the reduction in decannulation time and LOS would be 10 days (25%) and 12 days (20%) respectively. For the healthcare provider outcomes, the achievement of job satisfaction and acquiring of skills and knowledge in caring clients with tracheostomy would be focused. For the system outcomes, a potential saving of HK$ 276,000 could be generated annually after implementation of the proposed practice.
Declaration

I declare that this dissertation represents my own work, except where due acknowledgment is made, and that is has not been previously included in a thesis, dissertation or report submitted to this University or to any other institution for a degree, diploma or other qualifications.

__________________________
Chan Lok Man
July, 2015
Acknowledgment

I would like to express my deepest gratitude to my dissertation supervisor, Dr Joyce O. K. Chung, for her enlightenment and patience with my dissertation. She has always been sincere and helpful in making suggestions for me to refine my dissertation.
Table of Content

Declaration .................................................................................................................................i

Acknowledgment .....................................................................................................................ii

Table of Content ........................................................................................................................iii-v

List of Abbreviations ..................................................................................................................vi

Chapter 1 Introduction ...................................................................................................................1

1.1. Background ...........................................................................................................................1
1.2. Affirming Needs .....................................................................................................................10
1.3. Objectives .............................................................................................................................13
1.4. Significance ...........................................................................................................................14

Chapter 2 Critical Appraisal .........................................................................................................17

2.1 Searching Strategies ...............................................................................................................18
2.2 Data Extraction and Appraisal Strategies .................................................................................20
2.3 Results ..................................................................................................................................20
2.4 Synthesis ...............................................................................................................................23

Chapter 3 Translation and Application .....................................................................................27

3.1 Transferability of the selected studies .....................................................................................28

3.1.1 Target Setting ....................................................................................................................29
3.1.2 Target Audience ...............................................................................................................30
3.1.3 Philosophy of Care .............................................................................................................29
3.1.4 Estimated number of clients benefited ..............................................................................31
3.1.5 Estimated Implementation and Evaluation Duration .........................................................32

3.2 Feasibility of the intervention ...............................................................................................33

3.2.1 Availability of Staff and Resources ....................................................................................33
3.2.2 The Atmosphere of the Department and the Support from Administration ....................34
3.2.3 Potential Resistance and Obstacles

3.2.4 Skills Training

3.3 Costs-Benefit Ratio

3.3.1 Potential Risks of Implementation

3.3.2 Potential Benefits of Implementation

3.3.3 Inadequacy of the Current Practice

3.3.4. Potential Non-material Costs/Benefits

3.4 Evidence-based Protocol

Chapter 4 Implementation Plan

4.1 Communication Plan

4.1.1 Involvement of Stakeholders

4.1.2 Communication Process and Implementation Strategies

4.2 Staff Training

4.2.1 Training of work group members

4.2.2 Training of ward nurses

4.3 Pilot Testing

4.3.1 Strategies of Subject Enrollment

4.3.2 Decannulation Plan and Manner

4.3.3 Data Collecting and Recording

4.4 Evaluation Plan

4.4.1 Outcomes to be evaluated

4.4.1.1 Patient Outcomes

4.4.1.2 Healthcare Provider Outcomes

4.4.1.3 System Outcomes

4.5 Timing and Frequency of Taking Measurements

4.6 Nature and Number of Clients to be involved
4.7 Determination of protocol effectiveness

4.8 Ethical consideration

Chapter 5 Overall Summary

Reference

Appendix 1 Search Combination 70
Appendix 2 PRISMA diagram showing the flow of searching and extractions 73
Appendix 3 Table of evidence 74
Appendix 4 SIGN checklists 78
Appendix 5 Level of evidence by SIGN 94
Appendix 6 Grades of Recommendation by SIGN 95
Appendix 7 Flow Chart of tracheostomy progression to decannulation 96
Appendix 8 Equipment for opening of a tracheostomy (surgical approach) 97
Appendix 9 Equipment used in changes of Tracheostomy Tubes 98
Appendix 10 The St. Mary’s Tracheostomy care Bundle Checklist 98
Appendix 11 Information to include in hand-off of clients with tracheostomy 99
Appendix 12 Multiple-Choice quiz 100
Appendix 13 Evaluation for work group members - Train-the-Trainer (TOT) 103
Appendix 14 Evaluation of ward nurses --Post-Training 104
Appendix 15 Estimated man-hours for the management of tracheostomy

decannulation in critically ill patients (12 month period) 105
Appendix 16 Estimated cost for the management of tracheostomy

decannulation in critically ill patients (12 month period) 106
Appendix 17 Estimated saving from the proposed management of
tracheostomy decannulation (12 month period) 107
Appendix 18 Gantt chart for implementation of the decannulation protocol

over a Twelve-month period 108
**List of Abbreviations**

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABG</td>
<td>Arterial Blood Gas</td>
</tr>
<tr>
<td>APACHE II</td>
<td>Acute Physiology and Chronic Health Evaluation II</td>
</tr>
<tr>
<td>APN</td>
<td>Advanced Practice Nurse</td>
</tr>
<tr>
<td>COS</td>
<td>Chief Of Service</td>
</tr>
<tr>
<td>CXR</td>
<td>Chest X-Ray</td>
</tr>
<tr>
<td>DOM</td>
<td>Department of Operation Manager</td>
</tr>
<tr>
<td>EBP</td>
<td>Evidence-based Practice</td>
</tr>
<tr>
<td>EN</td>
<td>Enrolled Nurse</td>
</tr>
<tr>
<td>ENT</td>
<td>Ear, nose and throat</td>
</tr>
<tr>
<td>GCS</td>
<td>Glasgow Coma Scale</td>
</tr>
<tr>
<td>ICU</td>
<td>Intensive Care Unit</td>
</tr>
<tr>
<td>LOS</td>
<td>Length of Stay</td>
</tr>
<tr>
<td>MO</td>
<td>Medical Officer</td>
</tr>
<tr>
<td>MV</td>
<td>Mechanical Ventilation</td>
</tr>
<tr>
<td>NO</td>
<td>Nursing Officer</td>
</tr>
<tr>
<td>NC</td>
<td>Nurse Consultant</td>
</tr>
<tr>
<td>NS</td>
<td>Neurosurgery</td>
</tr>
<tr>
<td>OETT</td>
<td>Oro-endotracheal tube</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
<td>--------------------------------------</td>
</tr>
<tr>
<td>OT</td>
<td>Occupational Therapist</td>
</tr>
<tr>
<td>PT</td>
<td>Physiotherapists</td>
</tr>
<tr>
<td>QOL</td>
<td>Quality of Life</td>
</tr>
<tr>
<td>RCT</td>
<td>Randomized Controlled Trial</td>
</tr>
<tr>
<td>RN</td>
<td>Registered Nurse</td>
</tr>
<tr>
<td>RR</td>
<td>Respiratory Rate</td>
</tr>
<tr>
<td>SAPS</td>
<td>Simplified Acute Physiology Score</td>
</tr>
<tr>
<td>SIGN</td>
<td>Scottish Intercollegiate Guidelines Network</td>
</tr>
<tr>
<td>SpO2</td>
<td>Peripheral Capillary Oxygen Saturation</td>
</tr>
<tr>
<td>TBI</td>
<td>Traumatic Brain Injury</td>
</tr>
<tr>
<td>TOR-BSST©</td>
<td>The Toronto Bedside Swallowing Screening Test</td>
</tr>
<tr>
<td>TRAMS</td>
<td>Tracheostomy Review and Management Service</td>
</tr>
<tr>
<td>ST</td>
<td>Speech Therapists</td>
</tr>
<tr>
<td>WOB</td>
<td>Work of breath</td>
</tr>
<tr>
<td>WM</td>
<td>Ward Manager</td>
</tr>
</tbody>
</table>
Chapter 1

Introduction

1. Chapter Summary

In this chapter, the background of tracheostomy will be discussed, including the indications and complications of the prolonged uses. The objectives and the significance for applying an evidence-based guideline of tracheostomy decannulation in order to shorten the length of stay (LOS) in hospital and the importance of multidisciplinary approach will also be discussed.

1.1 Background

Tracheostomy, including surgical tracheostomy and percutaneous tracheostomy, is one of the most common procedures done in hospital, especially in those high demanding department, such as neurosurgery (NS) department and intensive care unit (ICU). Generally, surgical tracheostomy is ideally performed in the operation theatre, however, bedside tracheostomy is now considered as suitable location while extra transportation is not required, and client could be closely monitored post-operation immediately. For the surgery, an incision was made below the cricoid cartilage, then the strap muscles and thyroid isthmus would be retracted. Then the oro-endotracheal tube (OETT) would be withdrawn carefully but not removed till the tracheostomy tube was inserted. The OETT intubation would be
replaced in critically ill clients who require prolonged ventilation, since different complications associated with prolonged intubation, for instance, infection, patient discomfort, airway tissue trauma, need for high doses of sedation, post-intubation dysphagia and respiratory complications (Berney et al., 2014; Terragni et al., 2010). Other than the indication as prolonged mechanical ventilation, such artificial airway was required in patients suffering from neurological damage, which is secondary to the poor mental status, lower cranial nerve and/or brain stem deficits (Lazaridis et al., 2012). According to Brook et al (2000), respiratory weaning from mechanical ventilation could be promoted by early tracheostomy and the health care cost could also be reduced. Since clients receiving mechanical ventilation would require the use of sedation or other medications, plenty amount of oxygen and more manpower for maintaining intensive and high standard nursing care. In addition, the removal of excessive secretion, communication, nutrition, oral care and mobilization could be promoted by having tracheostomy (Loh & Irish, 2002). For example, sit out, bicycle training, standing and walking exercise. According to Cox et al. (2004), the use of tracheostomy has increased by nearly 200% in recent years; more than 100,000 tracheotomies were performed annually in the US (Healthcare Cost and Utilization Project, 2007), and the increase was reported consistently across countries (Parker et al, 2010). From these journals and studies, we could understand that tracheostomy has
been considered as a well-known common procedure which could bring numbers of advantages.

Nevertheless, complications related to the operation and the tracheostomy cannula would be inevitable and the tracheostomy management should be highlighted. Under proper and comprehensive management and nursing care, those complications could be prevented and well-controlled. However, similar to the situation of prolonged mechanical ventilation, numbers of problems and complications could be brought by prolonged use of tracheostomy also. Hence, the length of having tracheostomy for clients should be reduced as much as possible.

When nurses are caring clients received surgical tracheostomy, different aspects have to be observed and considered during the management, including indications for placing the tube, equipment (Appendix 8 and Appendix 9) used in the procedures such as opening of a tracheostomy and changing of cuffed tube to cuffless tube, early and late complications for the uses, tracheostomy emergencies and the assessment for readiness to decannulation. As nursing is a teamwork, it is critical to pass correct and comprehensive information to colleagues on next shift. For the information included in hand-off of clients with tracheostomy would be summarized in Appendix 11.
The role of a nurse is vitally important in facilitating tracheostomy decannulation. By acting as an instrumental role, through continuous nursing care and thorough assessment at the start of each, nurses should be able to identify whether the tracheostomy was placed for irreversible conditions and the readiness of patients to the next phases of care by measuring different parameters. Therefore, a plan for progressing tracheostomy decannulation could be initiated by nurses. Prior to assess the readiness of decannulation of tracheostomized patients, nurses should have knowledge on indications for insertion of a tracheostomy tube, types, limitations and cuff pressure of tube used. As mentioned before, number of parameters and criteria should be focused in the progression (Budweiser et al, 2012; Ceriana et al, 2003; Morris, McIntosh, & Whitmer, 2014; O’Connor and White, 2010). For the systematic approach, those considerations would be assessed in a “7-steps” progression to decannulation which was adopted and modified from Morris, McIntosh and Whitmer (2014), including: (1) haemodynamic stability and laboratory findings, (2) aspiration risk, (3) management of secretions, (4) cuff deflation, (5) uses of cuffless tube, (6) capping trials and then (7) decannulation. In each step of the progress, clients should be maintained in upright and neutral position, which promote the efficiency of the assessment, clients’ comfort and swallowing function. Furthermore, in order to fit in
the clinical setting, some of the steps in Morris et al (2014) were modified or even eliminated.

**STEP 1 - Haemodynamic stability and laboratory findings**

After client was liberated from mechanical ventilation (MV) support, time would be needed for stabilization. In order to determine stability, vital signs, such as GCS, blood pressure (BP) and pulse (P), body temperature, respiratory rate (RR) and peripheral capillary oxygen saturation (SpO2), would be measured in regular time intervals, e.g. hourly, every two hourly and then less frequently. Arterial blood gas (ABG) would be considered also, e.g. PaCO2 should be less than 60 mmHg (Ceriana et al, 2003). Chest X-Ray (CXR) would be suggested to rule out any pulmonary abnormality.

**STEP 2 - Aspiration risk**

Aspiration risk would be affected by the presence of dysphagia. It is commonly seen among older adults and clients who suffered from neurosurgical and/or neurological problems, which ranges from 15%-50% and 40%-60% respectively (Martino, Maki and Diamant, 2014; Robbins, 2002; Sandhaus, 2009). There are several benefits for having early detection of dysphagia through assessment and screening, for example, providing treatments earlier, and reducing medical
complications, shortening the LOS and reducing healthcare cost. Ability to swallow and cough strength is primary mechanism to protect the airway and contributes in determining the incidence of dysphagia. The risk of aspiration would be increased if secretions cannot be mobilized, hence, assessment for both parameters would be necessary before moving to further steps.

For the screening of dysphagia, swallowing of water would be used. According to Martino et al (2014), the 50-ml water protocol originally developed by Kidd et al (1993) would be commonly administered. The screening test includes 10 5-ml teaspoons of water were given once at a time, which has been considered a valid predictor of aspiration and dysphagia (Intercollegiate Stroke Working Party, 2012). Recently, “The Toronto Bedside Swallowing Screening Test” (TOR-BSST©) was developed for dysphagia screening which functions as a valid and reliable method. It gives 91.3% (CI 71.9 – 98.7) of sensitivity, 89.5% and 93.3% in specificity in rehabilitation clients and acute clients respectively (Martino et al, 2015). Similar to the test developed by Kidd et al (1993), but a cup sip of water was included after 10 5ml teaspoons of water were administered. Compare to expensive and complicated tests like Videofluoroscopic Swallowing Study (VFSS), TOR-BSST could be performed by trained nurses in daily assessment. Nevertheless, the importance of ST should not be neglected, while they should be referred by nurses for having more
complicated and expensive full assessments when encountering difficulties and doubts during assessment.

**STEP 3 - Management of secretions**

The characteristics of secretions should be recognized, including: colour, thickness, odor or foul smell, and the requirement of suctioning. Three factors would contribute the mobilization of secretions: physical mobility, removal of secretions and adequate hydration. For the physical mobility, “sit out” of the clients is one of the major routines in the neurosurgical ward, which aids in lung expansion and adaptation of exercise after a period of bed resting. PT could be referred for having their expert support, especially “Chest Physiotherapy” (Chest Physio). Clapping or percussion of the trunk of clients (chest, back, and mid-axillary area) would be included. Considering the thickness of secretions, it would be affected by the adequacy of hydration. If the secretions are thick, it could show the hydration state of the client and it would be difficultly mobilized by suctioning or coughing.

**STEP 4 - Cuff Deflation**

Considering the cuff of the tracheostomy tube, the normal cuff pressure should be 20 to 25 cmH2O with most tracheostomy tube (Morris et al, 2014). The cuff is used to seal the airway to maintain adequacy support from MV instead of preventing aspiration (Amathieu et al, 2012; Ding and Logemann, 2005). Regular
monitoring the cuff pressure is necessary to prevent the cuff is either over-inflated or under-inflated. If the cuff is over-inflated, ischaemia would be caused and damaging the trachea and/or oesophagus, i.e. Tracheoesophageal fistula. If the cuff is under-inflated, the efficiency of MV support would be reduced. Hence, once the client has been liberated from MV support and passed the “Step 3”, cuff deflation should be preceded as soon as possible.

Before deflating the cuff, suctioning should be performed to clear the large amount of secretions collected around the cuff. Once deflated the cuff, clients might react strongly due to the movement of air in their oropharynx, a feeling of unfamiliar would be resulted. Hence, explanations should be given to clients first. After deflation, client should be assessed to see any signs of respiratory distress, for instance, desaturation, increased work of breath (WOB) and stridor. A low flow of oxygen support could be considered until stability achieved.

STEP 5 - Uses of Cuffless Tube

After a period of cuff deflation adapted by the client, i.e. 24 hours or longer, cuffless tube could be considered to be changed. Capping trials could be allowed after cuffless tube was used and adapted. Although “Shiley” and “Portex” tubes are the choices, “Shiley” tube would be preferred as it is dual cannula tube; the reusable inner cannula could be regularly removed and replaced for cleansing, which minimize the
chance of tube obstruction. For the inner cannula, the optimal frequency for cleansing has not been shown by current studies, change every shift would be suitable for the clinical setting, which could ensure a patent airway was achieved. A more frequent change would be needed if a high risk of tube obstruction was anticipated.

**STEP 6 - Capping Trials**

By capping the opening of the cuffless tube, airflow would be redirected through the upper airway, instead of entering and existing through the tube. According to Christopher (2005), numbers of benefits would be resulted, especially restoring speech, glottis function and Valsalva movement, i.e. cough and swallow. It would be crucial that cuffed tube should not be used in the trials. Even the cuff was deflated; the resistance of the airflow would be severely increased by the bulk of the deflated cuff (Christopher, 2005; Morris, 2010). Since the opening of the tracheostomy tube was capped, oxygen should be given through nasal cannula. However, clients under capping trials should be monitored intensively; capping trials must be stopped if there is any sign of respiratory distress. The cap has to be removed immediately and suctioning should be performed.

Speaking valve could be used for clients who cannot tolerate the capping. Inspiration would be allowed through the tube, but airflow would be forced through the upper airway, while the valve would close during exhalation period. ST could be
referred for providing the valve and speech training (e.g. Phonation), which acts as an interim step for clients who cannot tolerate capping of the tracheostomy tube.

Although significance differences might not be shown in some outcomes due to the relatively small sample size and cohort study in nature, it still showed the intervention would be beneficial to the compliance of speaking valves (Cameron et al, 2009; LeBlanc et al, 2010)

**STEP 7 – Decannulation**

According to Morris (2010), after the cuffless tracheostomy tube was capped and free from respiratory distress for 24 to 48 hours, the client could be considered as ready for decannulation. Although the tube is “simply” removed by nurse, explanation should be given before the removal. After the tube was removed, the stoma should be covered by sterile gauze, which would heal within 1 day to 2 weeks (O’Connor & White, 2010). In order to prevent infection and promote healing, daily cleansing of the stoma by normal saline and changing of the gauze would be suggested.

**1.2 Affirming Needs**

Although tracheostomy could be used to maintain a relatively safe airway, and also being counted as a means to facilitate the weaning from MV, aspiration of tracheal aspiration and nursing care (Bittner and Schmidt, 2012; Tobin and Santamaria,
2008), the use of tracheostomy could also cause numbers of complications, which could be divided into three categories, i.e. immediate, short term and long term complications (Byard and Gilbert, 2011; Grillo, 2004; Kapadia, Bajan and Raje, 2011; Kapadia et al, 2001). For immediate complications, include haemorrhage, subcutaneous emphysema and lost of the airway; For the short term complications, include wound infection, damage to tracheal mucosa, tube obstruction, partial or complete tracheostomy tube displacement, and loss of the physiological humidification of the inspired air; For the long term complications, include tracheal stenosis, tracheomalacia, swallowing problems, formation of granuloma and persistent stoma. Furthermore, the well-being and body image of those clients would be affected by the tracheostomy. According to the qualitative study conducted by Sherlock, Wilson and Exley (2009), having a tracheostomy would induce a complex mixture of physical and psychological burden to clients and the effects would be greater than expected.

Those complications could delay the rehabilitation process, reduce patient comfort and associated with longer length of stay (LOS) in the acute care hospital. Hence, a higher cost in hospitalization and home care would be resulted (Berney et al., 2014; Budweiser et al., 2012; Lazaridis et al., 2012; LeBlanc et al., 2010; Leung et al., 2003; Warnecke et al., 2013). For example, close monitoring with significant support
would be required for tracheostomized patients who need frequent suctioning or aspiration, i.e. additional resources and manpower consumed. Hence, decannulation of tracheostomy would be a must to be considered. Decannulating a tracheostomy would be the fundamental step in rehabilitation, which facilitating the recovery from critical illness, promoting the rehabilitation status, shorten the length of stay (LOS) and also enhancing the quality of life (QOL). With an interview of a ward manager, the prices of different commonly used tracheostomy tubes were obtained: “Portex” cuffed tracheostomy tube costs $108, while cuffless and cuffed “Shiley” tracheostomy tube are cost $260. Due to the contract and huge amount of tracheostomy tubes purchased, the prices are relatively lower than expected. The overall healthcare cost of client might not be burdened by the tube itself, but the cost of LOS does.

For the decannulation progression, identifying contributing factors to ensure the readiness of decannulation would be critical, instead of simply tube removal straightforwardly. It is important to determine the initial need for the tracheostomy has been resolved. Numerous research has shown that the number of parameters and criteria should be considered, including level of conscious, i.e. The Glasgow Coma Scale (GCS), free from MV support, haemodynamic stability, cuff deflation, volume of oral and pulmonary secretion, cough effectiveness, and swallow function, requirements of oxygen, laboratory parameters and ability to tolerate tracheostomy
tube occlusion. The consideration of those factors was stated as necessary for the optimal timing for decannulation of tracheostomy. Measuring tools should also be included for weighing those factors, for example, Simplified Acute Physiology Score (SAPS) and Acute Physiology and Chronic Health Evaluation II (APACHE II). However, only the critical care nurses might not be sufficient, while they might not be qualified and allowed for measuring and interpreting those factors, and also not authorized for prescribing treatments to deal with the abnormal measures. Hence, the decannulation process would be delayed or prohibited.

The target neurosurgery (NS) unit is under surgical department in an acute hospital with over 70-year history in Hong Kong. Although decannulation strategies are specified and tend to be institution-dependent, no protocol and guideline considering tracheostomy decannulation was developed by this moment. After weaning from MV, decisions regarding decannulation of tracheostomy usually depend on the medical officer’s individual experience. In order to enhance the planning and organizing the progress of tracheostomy decannulation, constructing a specialized multi-disciplinary team would induce a positive impact on it. The care and management could be optimized and morbidity would also be reduced by staffs who have sufficient skills and experiences in carry for tracheostomized clients. (Berney et
al., 2014; Cetto et al., 2011; Frank et al., 2007; LeBlanc et al., 2010; Tobin and Santamaria, 2008).

1.3 Objectives and clinical question

From the discussion above, the objectives of this dissertation are:

1. To evaluate current evidence on the effectiveness of using a multi-disciplinary approach as compared with physician-directed practice on the duration of tracheostomy,

2. To develop an evidence-based guideline for nurse-initiated multi-disciplinary approach on weaning procedures,

3. To assess the transferability and feasibility of implementing the approach in weaning procedure,

4. To develop implementation strategies and evaluation plan for the use of the approach.

According to the study, a clinical question would be formulated with the format of PICO, including:

P) Population: Tracheostomized clients in critical care settings

I) Intervention: Nurse-led multi-disciplinary team management

C) Comparison: Current practice (Physician driven)

O) Outcome: Time to decannulation, length of stay (LOS)
**Clinical Question**

For tracheostomized clients in critical care setting, is a nurse-led multi-disciplinary team management improving the time to decannulation and length of stay while comparing to the current practice?

**1.4 Significance**

Considering the team, it was generally suggested medical officer (MO), respiratory therapist, nurse, physiotherapist (PT), occupational-therapist (OT) and dietitian should be recruited (Berney et al., 2014; Cetto et al., 2011; Frank et al., 2007; LeBlanc et al., 2010; Tobin and Santamaria, 2008). However, there are differences between the acute healthcare system in Hong Kong and the Western countries. For example, practicing respiratory therapists might not be available in local setting. In order to fit in the local setting and individual ward practice, modification of the team component would be necessary. Furthermore, as nurses should have spent much time on their patients comparing to other disciplines, evaluation of the readiness of the patients and the progress toward decannulation could be closely monitored by nurses. At the same time, in order to protect those decannulated patients from suffering complications, post-decannulation monitoring should also be done by nurses. Hence, nurses should be able to be the facilitators and initiators to execute systematic approaches for the whole tracheostomy progression.
Nevertheless, collaborative and synergetic contribution would still be significantly benefiting to the whole healthcare system as followings:

A) **Patients Care:** Patients would be comprehensively assessed and managed before decannulation. The chance of re-cannulation would be minimized. Hence, the LOS would be shortened, rehabilitation process could be facilitated. Finally, the medical cost would be reduced.

B) **Professionalism:** Synergetic cooperation could enhance the sharing of specialized knowledge and experience within the group. Especially the nursing aspect, since the time spent on patients by them would be the most, they could clearly understand patients’ conditions, and hence they could take up a more proactive instrumental role in the provision of quality decannulation. As a result, they might gain sense of achievement and belongings and also job satisfaction. And it could be a mean to retain nurses.

C) **Hospitals / Departments:** As additional cost of the medical care would be reduced, and also the attrition of nursing. More resources could be spent on multi-area, for instance, recruiting more manpower, purchasing advanced equipment and providing continuing education funding. As a result, higher standard of care could be maintained and provided.
Chapter 2

Critical Appraisal

2. Chapter Summary

In this chapter, the strategies for searching relevant studies related to tracheostomy decannulation and multi-disciplinary approach were shown. Relevant keywords and electronic databases used in the searching were also stated. Results were shown in format of table of evidence. Quality for the selected studies would be also discussed in the part of summary and synthesis.

2.1 Searching strategies

In order to identify potential studies, systematic searching was done via electronic databases available in the Yu Chun Keung Medical Library of the University of Hong Kong. PubMed, Medline and CINAHL were the databases used.

For the keywords used in searching potential literatures, “tracheostomy”, “tracheostomy tube”, “tracheotomy”, “decannulation”, “interdisciplinary”, “multidisciplinary”, “team management” were chosen. The combinations of keywords used and results yielded would be shown in Appendix 1. There were 24, 22, 4 potential studies being identified in three electronic databases. In order to maximize the number of potential studies, the reference lists of those potential studies were reviewed, 17 potential studies were identified. After screening
for the titles, abstract and relevance to keywords, 8 studies were identified and adopted. The PRISMA diagram would be used to show the flow of searching and extraction in Appendix 2.

For those studies, the inclusion criteria were: (1) In English language; (2) The age of patients $\geq$ 18 years old; (3) Critically ill patients including neurological and neurosurgical problems; (4) Multidisciplinary / interdisciplinary approach; (5) Outcomes are LOS and time to decannulation; (6) Publication year was 2004-2014.

Exclusion criteria were: (1) Patients with structural abnormalities; (2) Permanent tracheostomy; (3) Reviewed articles; (4) The team member consists of medical and nursing staff/ or medical staff only.

Randomized controlled trials (RCTs) were put in a high rank of level of evidence, and it should be preferable for constructing a study or translating researches. However, it might not applicable all the time.

2.2 Data extraction and Appraisal Strategies

After systematic searching, data extracted from selected studies were summarized into tables of evidence in Appendix 3, including study type, intervention, sample size, results, significance and the grading.

Considering the quality of studies recruited, a methodology checklist developed by Scottish Intercollegiate Guidelines Network (SIGN, 2005) would be
used to assess and evaluate those studies (Appendix 4). For the checklist, several areas were addressed, including:

(1) The clarity of defined research question

(2) The selection of subjects: Comparability and the number of subjects

(3) Drop-out

(4) The clarity of chosen outcomes and the measurement defined

(5) Reliability of the method of assessment of exposure

(6) Identification of confounders

(7) Results of the study

(8) Confidence interval

(9) Application to local settings

(10) Fitness with other available evidence

(11) Implication

The quality of the potential studies would be according to the level of evidence and grades of recommendation suggested by Scottish Intercollegiate Guidelines Network (SIGN, 2014). Details would be shown in Appendix 5 and Appendix 6.
2.3 Results

Considering the 8 studies extracted for supporting the proposed practice, 5 of them are retrospective cohort studies (Berney et al, 2014; Frank et al, 2007; LeBlanc et al, 2010; De Mestral et al, 2011; Parker et al, 2010), while the another 3 studies are prospective cohort studies (Cameron et al, 2009; Cetto et al, 2011; Tobin & Santamaria, 2008)

Retrospective cohort studies

For the study of Berney et al (2014), a newly coordinated multidisciplinary unit was created in the Acute NeuroRehabilitation (NRA) unit of an acute university hospital in Switzerland. For the NRA unit, neuropsychologist, medical officer, speech therapists (ST), occupational therapists (OT) and a clinical nurse specialist were recruited. By comparing data collected in two different periods, i.e. pre-NRA group and post-NRA group, the impact of the efficiency in weaning tracheostomy under management by NRA was assessed by measuring the reduced weaning time and time of being registered in medical rehabilitation centre for weaned patients.

In Frank et al (2007), a multidisciplinary approach was administered in the Swiss Neurological Rehabilitation Centre (REHAB), which was used to promote tracheotomy decannulation in clients suffering from neurogenic dysphagia. In the multidisciplinary team, physician, nurse and ST were included. For the approach, different specific criteria for determining the readiness for decannulation would be
assessed and discussed by the team member. Also, decision chart was also available for evaluating the readiness. In order to assess the impact of the team approach, data would be collected retrospectively for the pre- and post- intervention group, which focusing on the length of cannulation time and length of decannulation time.

With reference of LeBlanc et al (2010), clients suffered severe traumatic brain injury (TBI) who received tracheostomies were managed by specialized multidisciplinary tracheostomy team in the tertiary care trauma center of McGill University Health Centre–Montreal General Hospital (MUHC-MGH). In addition to physician, nurse, and ST, “trauma” surgeons and respiratory therapists were included to enhance the specificity. By collecting and analyzing data from pre- and post-intervention group, LOS, time to decannulation and the use of Passy-Muir speaking valve (PMSV) were shown to assess the effectiveness of the approach.

In the study of De Mestral et al (2011), surgeon, physician, respiratory therapists, speech therapist and clinical nurse specialist were included in a multidisciplinary tracheostomy team created at a tertiary care, level-1 trauma centre and teaching hospital. The impact of the dedicated interdisciplinary approach was assessed by measuring tracheostomy care outcomes, including time to downsizing the tracheostomy tube in TBI clients, days to first downsizing, incidence of tube blockage,
days to decannulation and the use of speaking valve. Also, the specific roles of each tracheostomy team members were mentioned.

In Parker et al (2010), quantitative and qualitative evaluation were included after implementation of an interdisciplinary team approach on tracheostomy care in a large regional tertiary care hospital in Australia. In addition to nurse consultant (NC), ST, physiotherapist and physicians, dietitian and medical social worker were included. Furthermore, consultation of ICU and respiratory specialists would be necessary if indicated. For the quantitative aspect, LOS and number of patients discharged from critical care units were measured. For the qualitative aspect, several areas were addressed through nurses’ reflections, for example, staff knowledge, acceptance of their roles and awareness of roles of other team members.

**Prospective cohort studies**

For the study of Cameron et al (2009), the Tracheostomy Review and Management Service (TRAMS) was introduced in a tertiary hospital in Melbourne, where including acute, sub-acute and rehabilitation setting. Number of services could be provided by TRAMS, for instance, incident review, education to clients and colleagues. The impact and effectiveness were determined by comparing the LOS, cannulation duration and the use of speaking valve of two groups of tracheostomized
clients before and after implementing the TRAMS in two different 3-year periods, i.e. matched-pairs design with two cohorts.

In Cetto et al (2011), multidisciplinary approach was implemented in a teaching hospital in London. By comparing data collected in cohorts (19-month pre-intervention and 19-month post-intervention), effectiveness were shown by analyzing time to decannulation, tracheostomy time and LOS in ICU. Furthermore, the details of care bundle and education program were shown.

For the study of Tobin, & Santamaria (2008), the team approach was implemented and assessed in an ICU of a tertiary referral hospital in Australia. Although PT, ST and dietitian were recruited in the team, “intensivist-led” was the focus within it, while intensivist and ICU liaison nurse were highlighted. The LOS in hospital, length of stay after ICU discharge and decannulation time were measured over a 4-year period.

2.4 Synthesis

Although RCTs would be the best choice for examining the effect of an intervention towards a selected outcome to be tested, its feasibility still depends on the study area and the intervention going to be tested. Quality cohort studies could be the answer in examining some sorts of intervention in nursing.
Studies showing clear research questions or statements were selected and adopted. Multidisciplinary or interdisciplinary approach for tracheostomy decannulation was the focus in those studies. And patients suffered from different critical illnesses and severities, including neuro-related problems (TBI, neurogenic dysphagia) were chosen as target populations. Furthermore, clients required permanent tracheostomy or anatomical deficits were excluded to enhance the quality of the practices and studies.

Due to the relatively small sample size and the dropped out subjects, statistically significance might not be reached for some outcome measures. For example, in the study of Berney et al (2014), the mean weaning time (p = 0.11), the mean time to registered in rehab centre for weaned patients (p = 0.27). Although the p-values were not statistically significant, i.e. p = 0.11 and p = 0.27, some effects were still shown in the study, especially absence of complications and recannulation under management by the NRA. Furthermore, significance could still be achieved under multivariate analysis (Tobin and Santamaria, 2008).

From the collected data, adopted and relevant studies, interdisciplinary or multidisciplinary approach could be used to promote tracheostomy management and facilitate tracheostomy decannulation (Berney et al, 2014; Cameron et al, 2009; Cetto et al, 2011; Frank et al, 2007; LeBlanc et al, 2010; De Mestral et al, 2011; Parker et al,
2010; Tobin & Santamaria, 2008). By contributing and sharing experiences, skills and opinions of professionals from different disciplines, patients’ comforts and outcomes could be further promoted, including reduced complications, LOS and time to decannulation. Hence, the healthcare cost could be reduced. Furthermore, healthcare provider outcomes could also be promoted, for instance, knowledge, feeling of achievement and collaboration of other professionals. Considering the team, physician, nurse and ST would be the core members. At the same time, depends on the situation and complications, additional specialized professionals could also be referred and recruited, for instance, PT, OT, dietitian and ENT professionals. According to Morris, McIntosh and Whitmer (2014), members could be included but not limited. Although nurses were not authorized to prescribe “Decannulate the tracheostomy tube”, they still could be the facilitators in the progression.

The comprehensive checklist or steps for decannulation would be necessary and helpful for nurse to show the readiness of tracheostomized patients before informing physician to make decision. The “7-steps” progression could act as a backbone of the multi-disciplinary approach for tracheostomy decannulation. Once complicated situations were encountered by nurses during assessment, especially in swallowing, aspiration risk and management of secretions, ST and PT should be informed or referred for having their expert assessment, management and opinions.
Hence, by incorporating the “7-steps in decannulation” and “Multi-disciplinary team management”, nurses could show their importance and “Nurse-led” services could be resulted.
Chapter 3

Translation and Application

3. Chapter Summary

In previous chapter, background was introduced and critical appraisal of reviewed literatures was constructed. There are 8 journals with quality showing that multi-disciplinary approach would be effective on management of tracheostomy decannulation, it could be valuable that translating the evidences into guideline and applying it in the neurosurgery department. In order to reduce the decannulation time and length of stay in acute clinical setting by implementing the intervention, an intensive and thorough assessment would be needed for the implementation potential to develop an evidenced-based practice (EBP). According to Polit & Beck (2004), several factors should be considered and assessed, including the transferability of the findings, the feasibility of the implementation and the cost-to-benefit ratio of the intervention.

3.1 Transferability of the selected studies

3.1.1 Target Setting

Target clinical setting would be the neurosurgery unit in one of the local hospitals in Hong Kong which is committed to offering a comprehensive and high level of care to patients with neurosurgical conditions, for instance, head injuries with
intra-cranial haemorrhage or haematoma in different location, brain tumour, neurovascular diseases and other complications suffered by in-patients. In the unit, it consists of general neurosurgery ward and neurosurgery intensive care unit (NS-ICU). For the general ward, 33 beds are provided for admission, while 6 beds are provided in NS-ICU. In both ward, tracheostomy is one of the commonly seen medical equipment being used for ventilation. However, the intensive unit is the venue for operation, i.e. bed-side tracheostomy, while the decannulation of tracheostomy would be managed in general ward. Since 2010, invasive procedures done would be recorded in a “Procedure Book” in the NS-ICU, for instance, bed-side tracheostomy, chest drain insertion, and intra-ventricular irrigation. From 1/1/2009 to 26/12/2014, the numbers of bed-side tracheostomy done were 28, 37, 35, 39, 38 and 46 respectively.

According to the selected studies, the settings were focusing on intensive care unit (de Mestral et al, 2011; Tobin and Santamaria, 2008), neurocritical (Cetto et al, 2011; LeBlanc et al, 2010; Cameron, et al, 2009) and neuro-rehabilitation unit (Berney et al, 2014; Frank, Mader and Sticher, 2007) which are similar to the neurosurgery ward in local setting. Therefore, implementing the approach could be feasible and applicable for decreasing the decannulation time and length of stay in acute care unit.
3.1.2 Target Audience

The target audience of the approach was adult (Aged 18 or above) patients admitted to the neurosurgical ward who had undergone operation of temporary tracheostomy. In Berney et al (2014), Cameron et al (2009), LeBlanc et al (2010), Tobin and Santamaria (2008), clients had tracheostomy and received the multi-disciplinary approach mainly suffered from different neuro-related problems, including spinal injury, brain lesion, and brain injury. In addition to the neuro-related problems, clients who received tracheostomy and the approach suffered other complications which would not rarely seen in neurosurgery unit, e.g. failed extubation, upper airway edema from infection, prepared for further major operation, impaired swallowing and vocal function (Cetto et al, 2011; Mestral et al, 2011; Frank, Mader and Sticher, 2007). Due to the similarity of the characteristics of the audiences from these selected studies and local setting, those studies are considered as transferrable.

3.1.3 Philosophy of Care

Comparing the patients in different department, patients undergone neurosurgery tend to have higher dependence in different aspects, including mobilization, dressing, eating and toileting etc. Quality of life would be greatly impacted. Hence, rehabilitation should be early entered for promoting optimum state
or enhance the ease for discharge planning. The philosophy of the approach is to facilitate the management of tracheostomy decannulation, optimize the utilization of available resources, reducing the decannulation time and decrease the length of stay in the unit. Considering the vision of the Hong Kong Hospital Authority (2010), it mentioned “committing ourselves to the health of our community, thus helping its members to avoid the need to spend time in our hospitals whenever possible...” Also, according to the Queen Mary Hospital (2008), missions were clearly stated “To provide patient centered high quality service to the community in an effective and efficient manner by optimum utilization of available resources, through the concerted efforts of satisfying patients' needs, facilitating staff's motivation and inviting public participation.”, “To provide appropriate environment, staff and facilities for the education, training and development of nurses....”

For the Hospital Authority and the Queen Mary Hospital, based on the visions and mission, they share similar philosophy of care for their clients, i.e. providing the best therapeutic environment and patient-centered care. Hence, considering the similarities of the setting, target audience and philosophy of care from the studies and local setting, the approach could be considered as transferrable.
3.1.4 Estimated number of clients benefited

All adult neurosurgical patients received tracheostomy will be the target audience. Based on the calculation of the data from the “Procedure Book”, the average number of tracheostomized patients from 2009 to 2014 was 38. And, the increasing was noted.

3.1.5 Estimated Implementation and Evaluation Duration

Before implementing the proposed approach, background information, for example, guidelines and proposal development, cost-benefit analysis would be sent to administrative staff for approval and grant for it, including Chief of Service (COS), Department Operational Manager (DOM), Ward Manager (WM) and Nurse Consultant (NC). A committee would be set up to facilitate communication and handling enquiries from colleagues. Briefing sessions about the approach and components will be provided for frontline colleagues. In the implementation period, condition of patients would be assessed daily by either team nurse and/ or committee members in weekdays. According to Morris, McIntosh & Whitmer (2014), in addition to the length of stay, infection rates and overall health care costs could be reduced by daily assessment of the progress toward decannulation. Since the number of colleagues and committee members would be the greatest during this period, i.e. Day-shift, and A-shift or P-shift, the decannulation phase could be well managed and
also responded if tracheostomy-related clinical incidents happened. Although Freeman (2011) suggested that thorough assessment should be carried by team nurse at the start of each shift, the workload could be severely increased; frontline colleagues would be stressed and dissatisfied. Within that period, feedback from frontline colleagues by informal interviews will be collected and evaluated every 4 weeks. In this period, critical obstacles and difficulties in the usage of approach could be discussed and modified during the committee meeting every 2 weeks. As daily assessment was performed, the length of bi-weekly meeting would not be too long. In the evaluation period, survey would be sent to frontline colleagues for assessing the effectiveness of the approach every three month. Also, some hidden agenda might be discovered through the survey, and their opinion would be valuable for modification of the intervention. Considering the evaluation period, the change in decannulation days; length of stay; staff compliance, acceptability and attitudes towards the approach would be the focus.

3.2 Feasibility of the intervention

Considering the feasibility of an intervention, the importance of nursing autonomy would be greatly highlighted. According to Pilot and Beck (2004), several aspects should be considered and managed, including the availability of resources and staffs; the atmosphere of the department and the support from administration; and
potential resistance and obstacles of the intervention. Furthermore, skills training should also be pondered.

3.2.1 Availability of Staff and Resources

In the unit, there are 5 nursing staffs in each A and P shift in weekdays, including 1 person in-charge (IC) and 4 team nurses. Generally, the IC would be either APN or NO. If there is no APN or NO in that shift, the most senior RN would take the role. For the team nurses’ duty or routine, assessing the neurological status of clients with Glasgow Coma Scale (GCS), turning and cleansing, administration of medications, following prescription or treatment from medical officers and discharge patients etc. Once the approach is implemented, the workload of the team nurses might be slightly increased, since a more thorough and comprehensive assessment for tracheostomized clients would be necessarily conducted by them. However, less than 10 minutes might be needed for each tracheostomized client only.

The equipment required for the approach includes different types and sizes of tracheostomy tube. For the types, the Portex and Shiley would be chosen, while the Shiley consists of changeable inner cannula for cleansing. Also, cuffed and cuffless tracheostomy would be included. And the size would be 6.0 and 7.0, as these sizes are commonly used in the unit. For those tubes, they had been already purchase by the
Department and stored as stock in ward. Other than that, A4-paper would be needed for assessment and evaluation form which is purchased by the unit.

3.2.2 The Atmosphere of the Department and the Support from Administration

The target NS unit is under managed by one of the largest acute hospitals which has over 70-year in Hong Kong. It also cooperates with a university in Hong Kong as teaching hospital. Hence, plenty of opportunities and optimistic atmosphere would be provided to encourage colleagues to review current practices, in order to facilitate the development of practices and nursing staffs, and also promote the standard of nursing care. Within the unit, such action is welcomed as there are present of different study and research groups already. APN and NO could be the coordinators and advocators of the project. They are experienced and able to give advices in refining the project, especially giving suggestion and dealing with obstacles and difficulties faced in different periods.

Nevertheless, the approach would be suspended if the tracheostomy-related clinical incidents increased unexpectedly, for instance, occlusion, dislodgement and displacement of the tubes, desaturation after decannulated and re-insertion of tracheostomy tube. Evaluation must be conducted to investigate the possible causes and the approach will be modified and refined. Evaluation and report will be sent to COS and DOM fro approval before re-implementing it.
3.2.3 Potential Resistance and Obstacles

Complaints from colleagues, reluctance to change and poor compliance would be expected at the beginning of the implementation phase. In the early stage of it, they might feel the workloads were increased, since increased assessments and extra documentations were required. As mentioned before, our clients tend to have higher dependence and due to the busy routines in each shift, colleagues might feel more stressed which could lead to low compliance with the practice.

3.2.4 Skills Training

As there are number of steps in assessing the clients, staff training and briefing session would be necessary for implementing and maintaining the practice. Two 1-hour briefing and training sessions would be provided. The importance of the practice, assessments included and supports would be introduced. Also, the importance of autonomy, professionalism and role expansion in nursing would also be reinforced in the sessions.

3.3 Costs-Benefit Ratio

In order to implement and maintain the practice effectively, several crucial considerations should be discussed, including the potential risks and benefits of the implementation, the inadequacy of the current practice and the non-material costs/benefits.
3.3.1 Potential Risks of Implementation

The approach is aimed to reduce the decannulation time, decrease the length of stay and also reduce the number of tracheostomy-related clinical incidents. However, presence of risks during the implementation period would be inevitable but solvable. For example, prolonged spigotting the tracheostomy tube unnecessarily, wrong type of inner cannula was used during spigotting, wrong size and type of tracheostomy tube was suggested to change if needed. As a result, desaturation, suffocation and over irritated to airway would be foresaw. Furthermore, it could be lethal if the tracheostomy tube was pulled out by patients intentionally and unintentionally.

It is the reason that proper training should be conducted for frontline colleagues to ensure comprehensive assessments and education for clients could be performed by them.

3.3.2 Potential Benefits of Implementation

In previous chapters, the decannulation time and the length of stay could be potentially reduced by the approach was shown. Since tracheostomized clients encounter different needs for the continuous uses of the tube and difficulties in decannulation. By using comprehensive assessments and documentations, “tailor-make” care plan would be formed to facilitate the progress, hence, the extra
costs and fees from the prolonged hospitalization could be prevented, especially the manpower and equipment.

3.3.3 Inadequacy of the Current Practice

The current “Physician-driven” or “Physician-led” practice only depends on the judgments of medical officers. There is no formal protocol used in assessing the condition of the tracheostomized clients and the readiness of decannulation. It could lead to longer decannulation time and length of stay. The cost to the department would be increased due to such prolonged hospitalization, including the manpower and equipment (Berney et al, 2014; Budweiser et al, 2012; Lazaridis et al, 2012; LeBlanc et al, 2010; Leung et al, 2003; Warnecke et al, 2013). Also, extra hospital fees that are incurred by the clients would be required, and their families would be heavily burdened.

3.3.4. Potential Non-material Costs/Benefits

Feelings and achievements of the frontline colleagues would be the main concerns. In the early phase of the approach, some colleagues would prefer the current practice and reluctant to change. Also, some colleagues would face difficulties in implementing comprehensive assessments and putting extra effort on it and documentations. Colleagues would be stressed and lead to decrease in staff morale. Hence, briefing and training session would be essential to deal with such obstacles.
The background and rationale of the intervention, and benefits for clients and colleagues would be introduced in briefing session. On the other hand, the skills and details in assessing tracheostomized clients would be highlighted in the training session. Their contribution and participation will be appreciated which could give a feeling of ownership of the project, also a sense of autonomy by colleagues themselves. In addition, channels will be provided for colleagues to share opinion and comment on the practice, for instance, interviews, surveys and suggestion box. The newly implemented practice could be improved by these channels, which is important in the evaluation plan also.

3.4 Evidence-based Protocol

In order to facilitate the implementation and adaptation of a new practice by colleagues, a user-friendly and clear guideline would be essential to guide the innovative nursing practice.

Title An evidence-based guideline on the management of tracheostomy decannulation in critically ill patients

Aim

--To reduce the decannulation time and the length of stay in NS ward

Objective

--To identify the parameters in tracheostomy progression to decannulation
--To standardize the practice of tracheostomy management and decannulation

--To enhance the competency of frontline nurses in caring tracheostomized clients

**Target Setting and Health Care Professionals**

MO/NO/APN/RN working in a Department of Neurosurgery in Hong Kong

**Target Subjects**

All adults (aged 18 or above) admitted to the ward under the Department of Neurosurgery who was undergone temporary surgical tracheostomy

EXCEPT patients with:

--Permanent need of tracheostomy due to anatomical reason or structural Abnormalities

--The need of tracheostomy to promote the priority in application of infirmary-bed for clients with poor potential for rehabilitation

**Recommendation and evidence grading**

The level of evidence and the recommendation are based on the Scottish Intercollegiate Guideline Network’s grading methods (SIGN). The level of evidence ranges from 1++ (Highest level) to 4 (Lowest level). And the grades of recommendation range from A (Highest) to D (Lowest). Detail would be shown in Appendix 5 and Appendix 6.
Recommendations

**Recommendation 1**  B

Clients with tracheostomy should be assessed by nurses daily, and ward round by multi-disciplinary or inter-disciplinary tracheostomy team is recommended through the whole progress after eligible clients were recruited.

*Evidence*

In order to facilitate comprehensive review and discussion to optimize the individualized care plan, ward round was suggested. However, different frequencies were mentioned, including daily (Cetto et al, 2011; Norwood et al, 2004), weekly (Parker et al, 2009) and twice weekly (Cameron et al, 2009; de Mestral et al, 2011; LeBlanc et al, 2010; Tobin, 2008). Comparing these common frequencies, twice weekly ward round would be preferred. Since clients have been assessed by frontline colleagues daily, the workload of different parties would be unnecessarily increased by the daily ward round. Also, twice weekly ward round was supported by more selected studies, which could ensure clear communication and sharing of information. (2+; 2++; 2++; 2+; 2+; 2+; 2+)

**Recommendation 2**  B

The initial indication and the further need of the tracheostomy for the client must be resolved and determined before considering progression to decannulation
Evidence

Severe complications or emergencies would exist if the tracheostomized client was not under well-stabilized or untimely decannulated, such as respiratory failure, respiratory infection, and blockage of airway and respiratory arrest. The length of hospitalization would be prolonged, and the healthcare cost would be increased also. (De Mestral et al, 2011)(2+).

Recommendation 3 B

After assessment and planning phase, “Care bundle checklist” (Appendix 10), “Tracheostomy progression checklist” (Appendix 7) and “Information list in hand-off clients with tracheostomy” (Appendix 11) could be used in every tracheostomized client during the implementation phase.

Evidence

Checklists could be used as a guide to standardize the tracheostomy care for clients in needed. The correct use of important ward-based components of an individual’s tracheostomy care plan would be well documented. Also, it could be considered as communication tools for colleagues to review the previous and current condition of the client, and also the progression to decannulation. Hence, the treatment plan could be optimized. (Berney, et al, 2014; Cetto et al, 2011) (2+; 2+)
Chapter 4

Implementation Plan

4. Chapter Summary

After translating research findings into clinical practice, transferring the knowledge to different levels of stakeholders would be required (Aita, Richer & Heon, 2007). The successfulness of adopting of the protocol would greatly rely on the acknowledgment of the changing process from individual to organizational context, including the steps of dissemination and implementation (Fretheim, Schunemann & Oxman, 2006). Hence, communication plan and strategies with all stakeholders would be significantly important. Pilot testing would be discussed and the way to try out the guideline would be shown.

Other than the communication plan and strategies, staff training, the evaluation plan of different aspects would be discussed, for instance, identifying the outcomes to be achieved, deciding when and how often to take measurements, the basis of the practice to be considered as effective. Furthermore, the determination of the nature and number of clients to be recruited would be discussed and shown by statistical analysis in this chapter. And, ethnical issue would also be included in this chapter.
4.1 Communication Plan

4.1.1 Involvement of Stakeholders

In order to maximize the effectiveness and efficiency of implementing and adopting an innovation or change of current practice in a clinical setting, having support from stakeholders would be crucial and essential. All parties or personnel influenced by the proposed changes or anticipated results of the innovation would be considered as stakeholders, for instance, administrators, users of the proposed innovation, people who support and oppose the proposed change, staff leading the change, trainers and supporting groups etc. Hence, the Chief of Service (COS), Department Operational Manager (DOM), Nurse Consultant (NC), Ward Manager (WM), Nursing Officer (NO), Advanced Practice Nurses (APN) and Registered Nurse (RN) within the Neurosurgery Department would be included. They are considered as internal stakeholders while they operate within a department. The COS, DOM and WM are important persons as essential resources could be provided to support the practice, especially approval must be gained from them prior to implementing innovations or make changes. NC would be considered as an authorized resource person. Generally, the roles of NC include expert practitioner, service planner or developer, educator, quality assurer and researcher. We could optimized our practices with their support, especially having opinions on (1) improving existing care
processes, (2) strengthening delivery of service through multi-disciplinary collaboration and (3) continuous quality maintenance and care standardization. APNs and/or NOs would be a sort of coordinator who could manage and supervise the delivery of the protocol due to their unique knowledge of advanced practice and valuable clinical experience. Furthermore, they tend to be the person in-charge (IC) of A-shift or P-shift, the operation of the proposed practice could be monitored by them as the proposed practice is suggested to be implemented during daytime. Within the department, the frontline RNs would be the majority who are responsible in conducting the proposed practice on clients who suffering neurosurgical problems and having temporary tracheostomies. Without their manpower support, the proposed practice would not be conducted fluently or even implemented. Hence, they have a pivotal role in the implementation phase.

For the parties or personnel who operate outside the setting would be considered as external stakeholders, speech therapists (ST) would be included. They are important members in providing expert opinions on management of clients suffering from difficulties in swallowing, i.e. Dysphagia, while the capability in saliva management would play an important role in determining the readiness to deflate the balloon of tracheostomy and further to decannulate it.
Furthermore, clients admitted in neurosurgery ward and their family members are also considered as stakeholders, as they received the management through the proposed practice. And, explanation of the general condition would be required to be given to the family members, especially the general idea of the management of tracheostomy.

4.1.2 Communication Process and Implementation Strategies

As those stakeholders are in different level and scope, different ways and strategies should be used when communicating with them. Formal and structured meeting would be held for stakeholders in administrative level, including COS, DOM and WM. They would be the targets who should be first approached. The framework of the whole process should be presented and explained in detail, including the background of the idea, the affirming needs, significance and the objectives of the proposed practice. In order to be convincingness and enhancing the chance of getting approvals for the proposed practice, supporting literatures or documents, and statistical data have to be shown in the meeting.

After having approval from administrators, communication with NC, NO and APN would be the following step. As the distance or ladder is relatively closer comparing to the administrators and they would be easier to approach, semi-formal meeting would be held for having their supports. Their experience on introducing
innovation, providing training to other RN, overseeing and monitoring the conduction of proposed practice would be crucial. Currently, measuring cuff pressure of the balloon of tracheostomy is one of the responsibilities of the A-Shift and P-Shift IC. However, in order to promote the standard and knowledge on tracheostomy care, it could be arranged to named nurses, for example, the indication of the cuff, the range of normal pressure of the cuff.

As RNs would be the majority within the department, dealing with them would be a great challenge. Before communicating with them, seeking the reluctance or fear to change would be necessary, for example, increased workload and unfamiliar to new practice would be obstacles to progress. Nevertheless, reluctant to change is a normal response, the attitude toward reluctance would be the key to successful change. In order to gain their supports, several group meetings and personal interviews would be needed; colleagues who support and oppose the proposed practice should be included also. Similar to the meeting with administrators and colleagues with advanced rank, background of the idea, rationales and the objectives of the proposed practice should be introduced. During the meeting, supports from administrators and colleagues with advanced rank should be shown and explained. Furthermore, several aspects should be highlighted, including, (1) Other than doing routines and following prescription from medical officers, the workload will be mildly increased only; (2)
Instead of internal deficiencies, external drives for change should be focused; (3) The
cost of not changing and stagnation. According to Palda, Davis & Goldman (2007),
better outcomes could be achieved by using multi-implementation strategies than
using single ones only, for instance, in-service training through interactive educational
meetings; use of reminder messages (Eccles et al., 2001; Registered Nurse
Association of Ontario ‘RNAO’, 2002); and ongoing communication through regular
staff representatives and unit meetings. Reluctance like lacking of confidence and
increased workload could be early identified and resolved by this strategy. Also,
adequate time could be provided for colleagues to adapt the transition and give
feedbacks. In the final phase in implementation strategies, the importance of
stabilization after having the propose practice should be highlighted. Continuous
supports should be available and provided to colleagues in need by coordinators
during weekdays, which could enhance the confidence of colleagues to adapt and
utilize the proposed practice.

In addition, resource manuals and pamphlets would also be available for
colleagues to have revision and given to clients’ families for better understanding
respectively. The resource manual will be kept updated to promote the standard of
nursing care by using the proposed practice. Team nurse or cubical nurses would be
responsible to clarify and answer questions raised by clients and their relatives, as they have the right to refuse undergoing the nurse-led practice.

**4.2 Staff Training**

In order to achieve successful implementation, colleagues should be familiar with the background of the proposed practice, and able to show understanding about the information. Training would be required for colleagues, it could be thought as a kind of investment or expense on them for the development of an organization. “Train-the-trainer” should be emphasized while numbers of hidden benefits could be brought by this concept, including: (1) reduces the long-term cost or dependence on costly external resources; (2) ensure the understanding of the trainers and application of interactive delivery techniques to the trainees; (3) aids in building self-confidence of the trainer by expanding their roles; (4) enhance their retention to the department by emphasizing the importance of their role.

**4.2.1 Training of work group members**

The team member of the nurse-led practice will be trained by the developer and speech therapist (ST) through workshop. During the workshop, basic anatomy and physiology involved in swallowing and saliva management will be presented by the ST. Several nursing aspect will be presented with the aid of PowerPoint slides and handouts, including the flow of proposed practice (Appendix 7), the uses and
complications of tracheostomy, equipment used for surgical approach of tracheostomy (Appendix 8), the care of clients with temporary tracheostomy, and the management of tracheostomy tube-related clinical emergency situations. The idea in assessing the readiness of client for decannulation will also be presented in the workshop; especially the steps of tracheostomy progression to decannulation will be highlighted and discussed in detail.

In order to ensure the work group members could show their understandings after participating the workshop, quiz would be required. A quiz with multiple choice questions (Appendix 12) would be given to the work group members and a pass (score 85% or above) would be required.

The presentation during the workshop will be video-recorded, and it will be used in training session of ward nurses.

4.2.2 Training of ward nurses

Similar to the workshop for group work members, but the information will be shown in the form of video with the supports of PowerPoint slides and handouts for remaining colleagues. They could make enquiries and seek advices from the trained work group members. Also, quiz with multiple choice questions (Appendix 12) will be given and a pass (score 85% or above) would be required.
4.3 Pilot Testing

After stakeholders were involved and having their approval and supports, a three-month pilot will be conducted after training workshops were given. It is defined as performing the proposed practice in a small-scale with preliminary manner prior to implementation of a proposed practice or innovation.

The objectives of the pilot testing are:

(1) To determine the feasibility of the proposed practice, whether amendments are needed to avoid unexpected obstacles prior to the larger scale implementation

(2) To determine the acceptability of the proposed practice among colleagues

(3) To select appropriate outcome measures for determining effectiveness of the protocol after implementation

According to Polit and Beck (2004), such as the acceptability of the proposed practice to the clients and colleagues, operational cost and guideline adherence would be concerned. Areas could be examined by the pilot testing, for instance, the strategies of subject enrollment, the decannulation plan and manner, evaluation of the programme outcome and collecting feedbacks from colleagues.

4.3.1 Strategies of Subject Enrollment

In order to test the feasibility of the strategies of subject enrollment for clients in the neurosurgical (NS) ward, inclusion criteria in the pilot test would be
same as the proposed decannulation progression. The details of the nature of clients involved would be discussed in the evaluation plan. In recruiting a pool of clients who underwent operation of temporary tracheostomy in NS ward, convenience sampling will be used. It would be useful as the sample population is readily available and accessible. Based on the data registered from the procedure book in NS ward, 10 clients could be recruited within the three-month period.

4.3.2 Decannulation Plan and Manner

According to Wilson, Harrison, Gibberd, & Hamilton (1999), the trial run of the pilot could be used to early identify any flaws and potential difficulties in the design of the practice. A safer system could be built to protect our clients suffered from adverse effect or inevitability of human error also. Clients will be screened and prospective data on patient condition will be recorded by programme coordinators, then senior medical officers (MO) will be noticed for clients who met inclusion criteria and recruited for the commencement of the trial. Primarily, assessment would be done by coordinators or work group members, and then followed by frontline colleagues, i.e. team nurses. Before decannulate the tracheostomy tube, senior MO or doctors with above rank will be informed for the results in evaluation of the readiness of the client to be decannulated. During the period, ward nurses will be encouraged to share opinions on the practice, for example, difficulties encountered during the pilot
test, special situations they observed. Their comments and feedbacks would be recorded anonymously and discussed in the meeting of work group members. For the meeting, it will be held bi-weekly in the first three months, then monthly in the next nine months. Several aspects will be focused in the meetings, for instance, possible solutions for difficulties encountered by colleagues, safety measures and satisfaction among colleagues. In order to sustain the change process, their compliance with the new practice would also be assessed by auditing the nursing charts, monitoring the client outcome. Furthermore, sharing success stories or cases, and keep making revisions to the practice would be useful in sustaining the change process. The overall timetable could be referred to Appendix 18.

4.3.3 Data Collecting and Recording

Demographic data (e.g. Age, ethnicity, gender), diagnosis, medical health history, operation done, length for having temporary tracheostomy, types of tubes used before decannulation process will be recorded. Although interjections from medical officers which could either hasten or delay the decannulation process, special notes would be taken and analyzed, which could be useful in revision of the practice in the future.
4.4 Evaluation Plan

According to RNAO (2002), evaluation should be developed prior to implementing any guidelines or protocols. Impacts would be induced during implementation; hence, it is significant to collect data to determine whether the proposed practice has been successful in addressing the affirming needs. Furthermore, according to Ciliska et al (2005), decisions on implementing the practice on more permanent basis could be facilitated.

4.4.1 Outcomes to be Evaluated

Outcomes identified and to be evaluated can be categorized into patient outcomes, healthcare provider outcomes and system outcomes. There are two advantages from such strategies: (1) Easy to compare the changes between pre- and post-implementation; (2) Cost could be reduced since the data were collected with established criteria (RNAO, 2002).

4.4.1.1 Patient Outcomes

After implementing an innovation, the primary result in client outcomes would be measured by assessing the clinical benefits of the practice. For the nurse-led decannulation process, the primary patient outcome to be measured is the total duration of having tracheostomy, i.e. The time from having tracheostomy until its decannulation finally. It is selected because there are evidences showing the protocol
could have a positive causal relationship. The length of decannulation time would rely on the timing for identifying the readiness of clients who are suitable to wean.

Secondary patient outcome would focus the length of stay (LOS) of the clients. It could be a great burden on different aspects, especially manpower, healthcare cost and also the family. Hence, the LOS will be necessarily considered and measured.

4.4.1.2 Healthcare Provider Outcomes

Besides patient outcomes, healthcare provider outcomes are also crucial parameters have to be considered, which are used to assess the acceptance or compliance level of staff to the practice. Evaluation of these outcomes could give additional information in explaining obstacles or barriers during implementation stage of pilot test. Several aspects would be focused and grouped into two main areas: (1) Skill and knowledge; (2) Satisfaction and confidence.

Structural factors (e.g. physical facility/equipment) and process factors (e.g. knowledge and skills) would also be important in evaluating and explaining negative findings in outcomes (RNAO, 2002), i.e. Skill and knowledge on decannulation progression (process) would rely on the educational endeavors (structure). If For example, if reduced length of decannulation were not achieved, structure data might indicate that there were not adequate education programs on decannulation
management, or process data might indicate that the education program was ineffective in increasing nurses’ skill and knowledge about decannulation management. Hence, other than the training session and resource manuals provided, the atmosphere of sharing and self-learning should be promoted and encouraged, for instance, case studies and discussion, and self-report questionnaire.

For the satisfaction and confidence, qualitative data should be collected by using semi-structured interview for focus group, including the awareness, attitude and perception to the practice. Under the system of multi-disciplinary collaboration, different disciplines should also be approached to yield specific and unique information towards the decannulation management. Moreover, the data collected from the interviews will be categorized and would be used for future modification of the proposed protocol in order to refine the protocol also. Evaluation forms would be referred to Appendix 13 and Appendix 14.

4.4.1.3 System Outcomes

System outcomes would be used to measure the system effectiveness, which cover facilities, supplies, equipment and organizational structure available in provision of care (RNAO, 2002). The key parameters used to be monitored include the costs, access to the practice and human resources. Cost effectiveness would be crucial in the evaluation, i.e. Annual savings. It would be determined by the difference
in costs for decannulation management before and after proposed practice and then the expenses of the practice.

\[
\text{Annual Savings} = (\text{Annual cost of decannulation management before implementation} - \text{Annual cost of decannulation management after implementation}) - \text{Annual expense of the proposed practice}
\]

4.5 Timing and Frequency of Taking Measurements

Since different parameters would be collected from different stakeholders, the time and frequency of measurement would vary. For the patient outcomes, short-term measurement would be considered, i.e. Weeks. Data would be collected prospectively from charts and progress notes throughout the implementation period. Readiness for decannulation progression would be measured and recorded through different parameters, such as hemodynamic stability, frequency for suction, cuff deflation. For the healthcare provider outcomes, intermediate and long-term measurements would be required, i.e. Months to a year. Since a new practice or changes in usual practice would take time for colleagues to utilize and adapt, which also rely on the educational endeavor provided. Hence, an extended period for pre- and post-implementation design evaluation of satisfaction and confidence, skill and knowledge of nurses would be required. For the perceptions of medical officers and speech therapists, it will be obtained through semi-structured interviews, while
sharing new ideas and opinions would be allowed. For the system outcomes, intermediate measurements would be expected, for instance, evaluation of the nursing manpower and the expenses contributed in the pilot test (e.g. stationeries, printing and publicity costs). Ward manager will be reported if additional resources are required.

4.6 Nature and Number of Clients to be involved

For the patient recruited in the pilot test for evaluation of the efficiency of the practice, the characteristics should be based on the previously identified and reviewed studies, so the homogeneity of patient groups could be maintained consistently. Patients admitted to NS ward who require tracheostomy operation to prevent prolonged intubation will be evaluated. Exclusion criteria are paediatric population; requirement of permanent tracheostomy due to anatomical indication; termination of mechanical ventilation due to medical futility or deterioration of clinical condition; or mechanical ventilation is required for client who is under brain death condition and organ preservation was indicated.

Convenience sampling method will be chosen, since participants are readily available and easily recruited. Furthermore, it is inexpensive when comparing to other sampling method. As mentioned before, according to the trend of recent years from the procedure book, there are approximately 40 new tracheostomy cases per year. Hence, from the three-month pilot testing period, there are approximately 10 cases
would be recruited in the period. For the major evaluations (Patients outcomes, healthcare providers’ outcomes and system outcomes) in the six-month implementation period, 20 cases could be recruited.

4.7 Determination of protocol effectiveness

Considering the basis for the proposed practice being deemed as effective, setting a realistic threshold value or criteria would be necessary, which could lead the entire plan tends to be more objective. By following the proposed practice, nurses would be able to assess the readiness of clients for decannulation. For the objectives of the practice, reduction of decannulation time and the length of stay in NS-ICU, the average values calculated from the selected studies are 14.91 days (rounded up: 15 days; ranges from 6.38 to 46.5 days, ) and 18.98 days (rounded up: 19 ; ranges from 5.02 to 37.87 days) respectively (Berney et al, 2014; Cameron et al, 2009; Cetto et al, 2011; Frank, Mader, & Sticher, 2007; LeBlanc et al, 2010; De Mestral, et al, 2011; Parker et al, 2010; Tobin, & Santamaria, 2008). While the calculated percentage changes are 38.0% (range from 15.5% to 49.1%) and 32.3% (range from 23.3% to 46.0%) respectively. However, as the proposed practice is newly implemented in the local setting, having a period of adaptation is inevitable. Hence, the target reduction of decannulation time and length of stay will be set at 10 days (25%; without rounded up: 9.80 days) and 12 days (20%; without rounded up: 11.75 days) respectively.
According to the HKSAR Government Gazette (2013), difference charges were included in the public ward maintenance fee, including general nursing, clinical, biochemical and pathology investigations, e.g. consultation, diagnostic imaging. Considering the cost saved by calculating the reduced LOS in ICU, $276,000 could be saved ($23000 x 12). Details will be included in Appendix 15 -Appendix 17.

For the healthcare providers aspect, increased in knowledge about tracheostomy (e.g. Indications, types, complications, clinical emergency situations) and its care from nursing aspect; increased in competency and compliance in carrying out assessments for readiness of decannulation and ability to perform the care correctly would be considered as successful criteria.

4.8 Ethical consideration

Considering this project, it is in the nature of quality improvement rather than a research one. According to RNAO (2002), “program evaluation and quality assurance might not be considered research in the clinical setting”, hence, approval from the Institutional Review Board (IRB) might not be required. However, there are still some ethical issues should not be disregarded. For instance, all data collected from the clients must be kept strictly confidential. Those data must be stored in a place where can only be accessed by authorized personnel, for example, project supervisor and coordinators. Information letter or pamphlet would be attached, while
clients or their families need to know the purpose of the practice and how their confidentiality and anonymity could be protected.
Chapter 5

Overall Summary

Nowadays, illnesses tend to be more complicated. Intubation of OETT would be indicated for protecting airway and providing mechanical ventilation for critically ill clients. Also, it could be used to buy time for deciding and providing more advancing treatments during the acute phases. Nevertheless, numbers of complication could be caused by prolonged OETT intubation. Hence, tracheostomy would be the choice for providing an advanced airway.

Surgical tracheostomy is a common procedure done in acute hospital. Comparing to clients under intubation, clients received tracheostomy would be easier to manage, and different benefits could be achieved. However, similar to the situation of OETT intubation, different complications and emergencies could be caused by the prolonged uses. As a result, different aspects within the healthcare system would be burdened, including organization (hospital, old age home), healthcare providers (medical staff, family members) and clients themselves. Hence, decannulation would be required to shorten the length of tracheostomy uses.

Generally it is physician-led, which depends on their individual experience. Although they are qualified and authorized to make medical decisions, they could not assess and monitor clients as close as nurses. Nevertheless, untrained nurses might not
have the skills and knowledge in tracheostomy decannulation. Numbers of literature stated multidisciplinary approach could be used to facilitate the tracheostomy progression to decannulation. Different specific skills and knowledge could be contributed by professionals in different area which could promote the efficiency of the approach.

After affirming needs and significances were identified, literatures review and critical appraisal were performed to yield quality studies which could contribute in developing the multidisciplinary approach on the management of tracheostomy decannulation through different electronic databases. In order to enhance the transferability of the potential studies, different inclusive and exclusive criteria were included on the basis of the local clinical setting. Furthermore, the acceptability of a proposed practice in local setting should be considered. The philosophy of care of the propose practice should be compared to that of the Hospital Authority and the Queen Mary Hospital, and similarity should be expected and achieved.

Feasibility of the proposed practice should be focused after transferability was confirmed. Different aspects should be considered, including: availability of manpower and resources, atmosphere of the local setting, supports from administration, potential resistance and obstacles, equipment and skill training.
Furthermore, cost-benefit ratio must be necessarily considered and presented, especially during the implementation plan.

In the implementation plan, several aspects should be addressed, including communication plan with stakeholders, staff training, pilot testing and evaluation plan. Communicating with stakeholders was needed to gain approval and supports from them, which facilitate the overall efficiency of the propose practice. Staff training was used to ensure the knowledge and skills were gained by colleagues for maintaining the standard of care. During the pilot testing, the proposed practice would be performed with preliminary manner. For the evaluation plan, patient outcome, healthcare provider outcome and system outcomes would be measured to determine of the effectiveness of the proposed practice.
Reference


### Appendix 1 - Search Combinations

Search combinations used in PubMed

<table>
<thead>
<tr>
<th>Search</th>
<th>Most Recent Queries</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>#8</td>
<td>Search #3 and #4 and #7</td>
<td>24</td>
</tr>
<tr>
<td>#7</td>
<td>Search #5 or #6</td>
<td>95993</td>
</tr>
<tr>
<td>#6</td>
<td>Team Management</td>
<td>34761</td>
</tr>
<tr>
<td>#5</td>
<td>Multidisciplinary or Interdisciplinary</td>
<td>70883</td>
</tr>
<tr>
<td>#4</td>
<td>Search #1 or #2</td>
<td>6921</td>
</tr>
<tr>
<td>#3</td>
<td>Decannulation</td>
<td>596</td>
</tr>
<tr>
<td>#2</td>
<td>Tracheotomy</td>
<td>2136</td>
</tr>
<tr>
<td>#1</td>
<td>Tracheostomy or Tracheostomy tube</td>
<td>5135</td>
</tr>
</tbody>
</table>
## Search combinations in Medline

<table>
<thead>
<tr>
<th>#</th>
<th>Searches</th>
<th>Results</th>
<th>Search Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tracheostomy.mp. or Tracheostomy/</td>
<td>10847</td>
<td>Advanced</td>
</tr>
<tr>
<td>2</td>
<td>Tracheostomy tube.mp.</td>
<td>926</td>
<td>Advanced</td>
</tr>
<tr>
<td>3</td>
<td>Tracheotomy.mp. or Tracheotomy/</td>
<td>9838</td>
<td>Advanced</td>
</tr>
<tr>
<td>4</td>
<td>Decannulation.mp.</td>
<td>1179</td>
<td>Advanced</td>
</tr>
<tr>
<td>5</td>
<td>1 or 2 or 3</td>
<td>18891</td>
<td>Advanced</td>
</tr>
<tr>
<td>6</td>
<td>Multidisciplinary.mp.</td>
<td>43744</td>
<td>Advanced</td>
</tr>
<tr>
<td>7</td>
<td>Interdisciplinary.mp.</td>
<td>31450</td>
<td>Advanced</td>
</tr>
<tr>
<td>8</td>
<td>Team Management.mp.</td>
<td>288</td>
<td>Advanced</td>
</tr>
<tr>
<td>9</td>
<td>6 or 7 or 8</td>
<td>72810</td>
<td>Advanced</td>
</tr>
<tr>
<td>10</td>
<td>4 and 5 and 9</td>
<td>22</td>
<td>Advanced</td>
</tr>
</tbody>
</table>
### Search combinations in CINAHL

<table>
<thead>
<tr>
<th>Search ID#</th>
<th>Search Terms</th>
<th>Search Options</th>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>S8</td>
<td>S3 AND S6 AND S7</td>
<td>Limiters - Full Text</td>
<td>View Results (4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Search modes - Boolean/Phrase</td>
<td></td>
</tr>
<tr>
<td>S7</td>
<td>S4 OR S5</td>
<td>Limiters - Full Text</td>
<td>View Results (10,555)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Search modes - Boolean/Phrase</td>
<td></td>
</tr>
<tr>
<td>S6</td>
<td>S1 OR S2</td>
<td>Limiters - Full Text</td>
<td>View Results (860)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Search modes - Boolean/Phrase</td>
<td></td>
</tr>
<tr>
<td>S5</td>
<td>Team management</td>
<td>Limiters - Full Text</td>
<td>View Results (306)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Search modes - Boolean/Phrase</td>
<td></td>
</tr>
<tr>
<td>S4</td>
<td>Multidisciplinary OR Interdisciplinary</td>
<td>Limiters - Full Text</td>
<td>View Results (10,359)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Search modes - Boolean/Phrase</td>
<td></td>
</tr>
<tr>
<td>S3</td>
<td>Decannulation</td>
<td>Limiters - Full Text</td>
<td>View Results (48)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Search modes - Boolean/Phrase</td>
<td></td>
</tr>
<tr>
<td>S2</td>
<td>Tracheotomy</td>
<td>Limiters - Full Text</td>
<td>View Results (14)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Search modes - Boolean/Phrase 3</td>
<td></td>
</tr>
<tr>
<td>S1</td>
<td>Tracheostomy or Tracheostomy tube</td>
<td>Limiters - Full Text</td>
<td>View Results (812)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Search modes - Boolean/Phrase</td>
<td></td>
</tr>
</tbody>
</table>
Appendix 2 – PRISMA diagram showing the flow of searching and extraction

Identification

Records identified through database searching (PubMed, Medline and CINAHL) (n = 50)

Additional records identified through other sources (n = 17)

Records after duplicates removed (n = 41)

Screening

Records screened (n = 41)

Records excluded (n = 15)

Eligibility

Full-text articles assessed for eligibility (n = 26)

Studies included in qualitative synthesis (n = 0)

Studies included in quantitative synthesis (meta-analysis) (n = 8)

Eligibility

18 Full-text articles excluded with reasons
1. Review articles (4)
2. No comparative outcome data (12)
3. Program description and no outcome data (2)

Included

### Appendix 3 - Table of Evidence

**Remarks:**
- LOS – Length of Stay
- NRA – Acute NeuroRehabilitation Unit
- PMSV – Passy-Muir speaking valve
- TBI – Traumatic Brain Injury
- TDMT – Tracheostomy Multidisciplinary Team
- TRAM – Tracheostomy Review and Management Service (TRAMS)

<table>
<thead>
<tr>
<th>No. of Journal</th>
<th>Author</th>
<th>Title</th>
<th>Study Type</th>
<th>Method</th>
<th>Sample Size</th>
<th>Results</th>
<th>Significance</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Berney et al. (2014)</td>
<td>Acute neurorehabilitation: Does a neurosensory and coordinated interdisciplinary programme reduce tracheostomy weaning time and weaning failure?</td>
<td>Retrospective</td>
<td>Compare two groups of tracheostomized patients before and after intervention (NRA) in 49 months</td>
<td>Pre-NRA group: 22 Post-NRA group: 22</td>
<td>‧ Mean weaning time (days): 19.13 to 12.75  ‧ Mean time to registered in rehab centre for weaned patients (days): 10.4 to 8.4</td>
<td>‧ p = 0.11  ‧ p = 0.27</td>
<td>2-</td>
</tr>
<tr>
<td>8</td>
<td>Cameron et al. (2009)</td>
<td>Outcomes of patients with spinal cord injury before and after introduction of an interdisciplinary tracheostomy team.</td>
<td>Prospective – Matched-pairs design with two cohorts, pre and post intervention</td>
<td>Compare two groups of tracheostomized patients before and after intervention (TRAMS) in two different 3-year period</td>
<td>Pre-TRAMS group: 34 Post-TRAMS group: 53</td>
<td>‧ Median LOS (days): 60 to 41.5  ‧ Median cannulation duration (days): 22.5 – 16.5  ‧ Use of speaking valve: 35% to 82%</td>
<td>‧ p = 0.03  ‧ p = 0.08  ‧ p &lt; 0.01</td>
<td>2+</td>
</tr>
<tr>
<td>No. of Journal</td>
<td>Author</td>
<td>Title</td>
<td>Study Type</td>
<td>Method</td>
<td>Sample Size</td>
<td>Results</td>
<td>Significance</td>
<td>Grade</td>
</tr>
<tr>
<td>---------------</td>
<td>--------</td>
<td>----------------------------------------------------------------------</td>
<td>---------------------</td>
<td>------------------------------------------------------------------------</td>
<td>------------------------</td>
<td>------------------------------------------------------------------------</td>
<td>--------------</td>
<td>-------</td>
</tr>
</tbody>
</table>
| 9             | Cetto et al. (2011) | Improving tracheostomy care: a prospective study of the multidisciplinary approach | Prospective         | Compare 19-month pre-intervention and 19-month post intervention cohort | Pre-TDMT group: 79 Post-TDMT group: 71 | • Mean time to decannulation (days): 21 to 11  
• Mean tracheostomy time (days): 34 to 25  
• Mean time of LOS in ICU: 19.16 to 14.14 | p < 0.0001  
p < 0.0001  
p = 0.08 | 2+   |
Group 2 (1997) : 12 | • Mean length of cannulation time (days): 75.4 to 28.3  
• Mean length of decannulation time (days): 94.7 to 48.2 | p = 0.004  
p = 0.016 | 2-   |
| 28            | LeBlanc et al. (2010) | Outcomes in Tracheostomized Patients With Severe Traumatic Brain Injury Following Implementation of a Specialized Multidisciplinary Tracheostomy Team | Retrospective       | Compare two groups of patients before and after implementation of the team approach | Group 1 (Pre-intervention): 27  
Group 2 (Post-intervention): 34 | • LOS (days): 107.81 to 69.94  
• Mean time to decannulation (days): 41.93 to 35.44  
• Use of PMSVs: 33% to 71% | p = 0.025  
p = 0.286  
p = 0.004 | 2-   |
<table>
<thead>
<tr>
<th>No. of Journal</th>
<th>Author</th>
<th>Title</th>
<th>Study Type</th>
<th>Method</th>
<th>Sample Size</th>
<th>Results</th>
<th>Significance</th>
<th>Grade</th>
</tr>
</thead>
</table>
Post-service group (2006): 54 | • Mean number of days to first downsizing in TBIs patients: 24.5 to 16.6  
• Mean number of days to first downsizing: 26.0 to 9.3  
• Tube blockage: 25.0 to 5.50  
• Days to decannulation: 50.4 to 28.4 | • p = 0.047  
• p = 0.23  
• p = 0.016  
• p = 0.91 | 2-               |
| 36            | Parker et al. (2010)  | Tracheostomy management in Acute care Facilities – a matter of teamwork | Retrospective      | Collect and compare data from the pre (12/06-5/07) and post (7/07-1/08) implementation group                                          | Pre-implementation group: 41  
Post-implementation group: 75 | • Mean LOS (days): 50 to 27  
• Number of patients discharged from critical care units: 19 to 54 | • p < 0.0001  
• p = 0.0056 | 2-               |
| 46 | Tobin, E. A., & Santamaria, J. D. (2008), An intensivist-led tracheostomy review team is associated with shorter decannulation time and length of stay: a prospective cohort study. | Prospective | Collect, measure and compare data from ICU patients discharged over the course of 4-year period (2003-2006). | 280 patients discharged to the ward with a tracheostomy | • Mean hospital LOS (days): 42-45 to 34.5  • Mean length of stay after ICU (days): 30 to 19  • Mean decannulation time (days): 14 to 7 | • p = 0.06  • p < 0.05  • p < 0.01 | 2+ |
Appendix 4 - SIGN Checklists

Checklist 1

**Methodology Checklist 3: Cohort studies**


Please note that a retrospective study (i.e. a database or chart study) cannot be rated higher than +.

<table>
<thead>
<tr>
<th>Section 1: INTERNAL VALIDITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>In a well conducted cohort study:</td>
</tr>
<tr>
<td><strong>1.1</strong></td>
</tr>
<tr>
<td><strong>1.2</strong></td>
</tr>
<tr>
<td><strong>1.3</strong></td>
</tr>
<tr>
<td><strong>1.4</strong></td>
</tr>
</tbody>
</table>
| **1.5** | What percentage of individuals or clusters recruited into each arm of the study dropped out before the study was completed? | Pre-Group: 35.3%  
Post-Group: 52.2% |
| **1.6** | Comparison is made between full participants and those lost to follow up, by exposure status. | Yes |

**ASSESSMENT**

| **1.7** | The outcomes are clearly defined. | Yes |
| **1.8** | The assessment of outcome is made blind to exposure status. If the study is retrospective this may not be applicable. | Not applicable |
Where blinding was not possible, there is some recognition that knowledge of exposure status could have influenced the assessment of outcome. Yes

The method of assessment of exposure is reliable. Yes

Evidence from other sources is used to demonstrate that the method of outcome assessment is valid and reliable. Yes

Exposure level or prognostic factor is assessed more than once. Can’t say

The main potential confounders are identified and taken into account in the design and analysis Yes

Have confidence intervals been provided? Yes

How well was the study done to minimize the risk of bias or confounding? Acceptable (+)

Taking into account clinical considerations, your evaluation of the methodology used, and the statistical power of the study, do you think there is clear evidence of an association between exposure and outcome? Yes

Are the results of this study directly applicable to the patient group targeted in this guideline? Yes

Since the study was retrospective type, the attrition rate was quite high, however, efforts to follow up participants that dropped out was reported clearly. Although the level of evidence is not strong as RCTs, it still showed the intervention could be further developed and modified.
Methodology Checklist 3: Cohort studies


Please note that a retrospective study (i.e. a database or chart study) cannot be rated higher than +.

### Section 1: INTERNAL VALIDITY

<table>
<thead>
<tr>
<th>In a well conducted cohort study:</th>
<th>Does this study do it?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 The study addresses an appropriate and clearly focused question.</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>SELECTION OF SUBJECTS</strong></td>
<td></td>
</tr>
<tr>
<td>1.2 The two groups being studied are selected from source populations that are comparable in all respects other than the factor under investigation.</td>
<td>Yes</td>
</tr>
<tr>
<td>1.3 The study indicates how many of the people asked to take part did so, in each of the groups being studied.</td>
<td>Yes</td>
</tr>
<tr>
<td>1.4 The likelihood that some eligible subjects might have the outcome at the time of enrolment is assessed and taken into account in the analysis.</td>
<td>Yes</td>
</tr>
</tbody>
</table>
| 1.5 What percentage of individuals or clusters recruited into each arm of the study dropped out before the study was completed? | Pre-Group 12.8%  
Post-Group 15.9% |
| 1.6 Comparison is made between full participants and those lost to follow up, by exposure status. | Yes |
| **ASSESSMENT** | |
| 1.7 The outcomes are clearly defined. | Yes |
| 1.8 The assessment of outcome is made blind to exposure status. If the study is retrospective this may not be applicable. | Not applicable |
| 1.9 | Where blinding was not possible, there is some recognition that knowledge of exposure status could have influenced the assessment of outcome. | Yes |
| 1.10 | The method of assessment of exposure is reliable. | Yes |
| 1.11 | Evidence from other sources is used to demonstrate that the method of outcome assessment is valid and reliable. | Yes |
| 1.12 | Exposure level or prognostic factor is assessed more than once. | Can’t say |
| **CONFOUNDING** | | |
| 1.13 | The main potential confounders are identified and taken into account in the design and analysis | Yes |
| **STATISTICAL ANALYSIS** | | |
| 1.14 | Have confidence intervals been provided? | Yes |

**Section 2 Overall Assessment Of The Study**

| 2.1 | How well was the study done to minimize the risk of bias or confounding? | Acceptable (+) |
| 2.2 | Taking into account clinical considerations, your evaluation of the methodology used, and the statistical power of the study, do you think there is clear evidence of an association between exposure and outcome? | Yes |
| 2.3 | Are the results of this study directly applicable to the patient group targeted in this guideline? | Yes |
| 2.4 | Notes. Summarize the authors’ conclusions. Add any comments on your own assessment of the study, and the extent to which it answers your question and mention any areas of uncertainty raised above. | Randomization and binding were not considered logistically possible, since intervention was directly implanted to patients and used for staff education. However, with comparison to other studies, it still shows the approach could be beneficial to tracheostomized patients. |
Please note that a retrospective study (i.e. a database or chart study) cannot be rated higher than +.

## Section 1: INTERNAL VALIDITY

<table>
<thead>
<tr>
<th>In a well conducted cohort study:</th>
<th>Does this study do it?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.1</strong> The study addresses an appropriate and clearly focused question.</td>
<td>Yes</td>
</tr>
</tbody>
</table>

### SELECTION OF SUBJECTS

| 1.2 | The two groups being studied are selected from source populations that are comparable in all respects other than the factor under investigation. | Yes |
| 1.3 | The study indicates how many of the people asked to take part did so, in each of the groups being studied. | Yes |
| 1.4 | The likelihood that some eligible subjects might have the outcome at the time of enrolment is assessed and taken into account in the analysis. | Yes |
| 1.5 | What percentage of individuals or clusters recruited into each arm of the study dropped out before the study was completed? | Pre-Group: 24.5%  
Post-Group: 25.3% |
| 1.6 | Comparison is made between full participants and those lost to follow up, by exposure status. | Yes |

### ASSESSMENT

<p>| 1.7 | The outcomes are clearly defined. | Yes |
| 1.8 | The assessment of outcome is made blind to exposure status. If the study is retrospective this may not be applicable. | No |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.9</strong></td>
<td>Where blinding was not possible, there is some recognition that knowledge of exposure status could have influenced the assessment of outcome.</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>1.10</strong></td>
<td>The method of assessment of exposure is reliable.</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>1.11</strong></td>
<td>Evidence from other sources is used to demonstrate that the method of outcome assessment is valid and reliable.</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>1.12</strong></td>
<td>Exposure level or prognostic factor is assessed more than once.</td>
<td>Can’t say</td>
</tr>
</tbody>
</table>

**CONFOUNDING**

| **1.13** | The main potential confounders are identified and taken into account in the design and analysis | Yes |

**STATISTICAL ANALYSIS**

| **1.14** | Have confidence intervals been provided? | No |

---

**Section 2 Overall Assessment Of The Study**

| **2.1** | How well was the study done to minimize the risk of bias or confounding? | Acceptable (+) |
| **2.2** | Taking into account clinical considerations, your evaluation of the methodology used, and the statistical power of the study, do you think there is clear evidence of an association between exposure and outcome? | Yes |
| **2.3** | Are the results of this study directly applicable to the patient group targeted in this guideline? | Yes |
| **2.4** | Notes. Summarize the authors conclusions. Add any comments on your own assessment of the study, and the extent to which it answers your question and mention any areas of uncertainty raised above. | Non-RCT study was the concern. Considering it was a cohort study, the attrition rate was relatively small; hence the sample size was relatively greater, providing better level of generalizability. |

Please note that a retrospective study (i.e. a database or chart study) cannot be rated higher than +.

### Section 1: INTERNAL VALIDITY

**In a well conducted cohort study:**

<table>
<thead>
<tr>
<th></th>
<th>Does this study do it?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.1</strong></td>
<td>The study addresses an appropriate and clearly focused question.</td>
</tr>
</tbody>
</table>

**SELECTION OF SUBJECTS**

<table>
<thead>
<tr>
<th></th>
<th>Does this study do it?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.2</strong></td>
<td>The two groups being studied are selected from source populations that are comparable in all respects other than the factor under investigation.</td>
</tr>
<tr>
<td><strong>1.3</strong></td>
<td>The study indicates how many of the people asked to take part did so, in each of the groups being studied.</td>
</tr>
<tr>
<td><strong>1.4</strong></td>
<td>The likelihood that some eligible subjects might have the outcome at the time of enrolment is assessed and taken into account in the analysis.</td>
</tr>
</tbody>
</table>
| **1.5** | What percentage of individuals or clusters recruited into each arm of the study dropped out before the study was completed? | **Pre-Group: 33.3%**  
                      **Post-Group: 39.3%** |
| **1.6** | Comparison is made between full participants and those lost to follow up, by exposure status. | **Yes** |

**ASSESSMENT**

<table>
<thead>
<tr>
<th></th>
<th>Does this study do it?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.7</strong></td>
<td>The outcomes are clearly defined.</td>
</tr>
<tr>
<td><strong>1.8</strong></td>
<td>The assessment of outcome is made blind to exposure status. If the study is retrospective this may not be applicable.</td>
</tr>
</tbody>
</table>
1.9 Where blinding was not possible, there is some recognition that knowledge of exposure status could have influenced the assessment of outcome. | Yes
---|---
1.10 The method of assessment of exposure is reliable. | Yes
1.11 Evidence from other sources is used to demonstrate that the method of outcome assessment is valid and reliable. | Yes
1.12 Exposure level or prognostic factor is assessed more than once. | Can’t say

CONFOUNDING
1.13 The main potential confounders are identified and taken into account in the design and analysis | Yes

STATISTICAL ANALYSIS
1.14 Have confidence intervals been provided? | Yes

Section 2 Overall Assessment Of The Study
2.1 How well was the study done to minimize the risk of bias or confounding? | Acceptable (+)
2.2 Taking into account clinical considerations, your evaluation of the methodology used, and the statistical power of the study, do you think there is clear evidence of an association between exposure and outcome? | Yes
2.3 Are the results of this study directly applicable to the patient group targeted in this guideline? | Yes
2.4 Notes. Summarize the authors’ conclusions. Add any comments on your own assessment of the study, and the extent to which it answers your question and mention any areas of uncertainty raised above. | Exclude the issue of non-RCT study; it mentioned the different roles of the team members clearly, which could aids in team formation and cooperation.
Checklist 5

**Methodology Checklist 3: Cohort studies**


Please note that a retrospective study (i.e. a database or chart study) cannot be rated higher than +.

**Section 1: INTERNAL VALIDITY**

<table>
<thead>
<tr>
<th>In a well conducted cohort study:</th>
<th>Does this study do it?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 The study addresses an appropriate and clearly focused question.</td>
<td>Yes</td>
</tr>
</tbody>
</table>

**SELECTION OF SUBJECTS**

| 1.2 The two groups being studied are selected from source populations that are comparable in all respects other than the factor under investigation. | Yes |
| 1.3 The study indicates how many of the people asked to take part did so, in each of the groups being studied. | Yes |
| 1.4 The likelihood that some eligible subjects might have the outcome at the time of enrolment is assessed and taken into account in the analysis. | Yes |
| 1.5 What percentage of individuals or clusters recruited into each arm of the study dropped out before the study was completed? | Pre-Group: 7.7%  
Post-Group: None |
| 1.6 Comparison is made between full participants and those lost to follow up, by exposure status. | Yes |

**ASSESSMENT**

| 1.7 The outcomes are clearly defined. | Yes |
| 1.8 The assessment of outcome is made blind to exposure status. If the study is retrospective this may not be applicable. | Not applicable |
1.9 Where blinding was not possible, there is some recognition that knowledge of exposure status could have influenced the assessment of outcome.

1.10 The method of assessment of exposure is reliable.

1.11 Evidence from other sources is used to demonstrate that the method of outcome assessment is valid and reliable.

1.12 Exposure level or prognostic factor is assessed more than once.

CONFOUNDING’

1.13 The main potential confounders are identified and taken into account in the design and analysis.

STATISTICAL ANALYSIS

1.14 Have confidence intervals been provided?

Section 2 Overall Assessment Of The Study

2.1 How well was the study done to minimize the risk of bias or confounding?

   Acceptable (+)

2.2 Taking into account clinical considerations, your evaluation of the methodology used, and the statistical power of the study, do you think there is clear evidence of an association between exposure and outcome?

   Yes

2.3 Are the results of this study directly applicable to the patient group targeted in this guideline?

   Yes

2.4 Notes. Summarize the authors conclusions. Add any comments on your own assessment of the study, and the extent to which it answers your question and mention any areas of uncertainty raised above.

   • The inequality of sample size would be the consideration.
   • The multidisciplinary decision chart for evaluating readiness would be helpful in team communication.
Methodology Checklist 3: Cohort studies


Please note that a retrospective study (i.e. a database or chart study) cannot be rated higher than +.

### Section 1: INTERNAL VALIDITY

**In a well conducted cohort study:**

<table>
<thead>
<tr>
<th></th>
<th>Does this study do it?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.1</strong></td>
<td>The study addresses an appropriate and clearly focused question.</td>
</tr>
<tr>
<td><strong>1.2</strong></td>
<td>The two groups being studied are selected from source populations that are comparable in all respects other than the factor under investigation.</td>
</tr>
<tr>
<td><strong>1.3</strong></td>
<td>The study indicates how many of the people asked to take part did so, in each of the groups being studied.</td>
</tr>
<tr>
<td><strong>1.4</strong></td>
<td>The likelihood that some eligible subjects might have the outcome at the time of enrolment is assessed and taken into account in the analysis.</td>
</tr>
</tbody>
</table>
| **1.5** | What percentage of individuals or clusters recruited into each arm of the study dropped out before the study was completed? | Pre-Group: 25%  
Post-Group: 15% |
| **1.6** | Comparison is made between full participants and those lost to follow up, by exposure status. | Yes |
| **1.7** | The outcomes are clearly defined. | Yes |
| **1.8** | The assessment of outcome is made blind to exposure status. If the study is retrospective this may not be | Not applicable |
Where blinding was not possible, there is some recognition that knowledge of exposure status could have influenced the assessment of outcome.  

The method of assessment of exposure is reliable.  

Evidence from other sources is used to demonstrate that the method of outcome assessment is valid and reliable.  

Exposure level or prognostic factor is assessed more than once.  

The main potential confounders are identified and taken into account in the design and analysis.  

Have confidence intervals been provided? Only standard deviation.  

How well was the study done to minimize the risk of bias or confounding?  

Taking into account clinical considerations, your evaluation of the methodology used, and the statistical power of the study, do you think there is clear evidence of an association between exposure and outcome?  

Are the results of this study directly applicable to the patient group targeted in this guideline?  

Notes. Summarize the authors conclusions. Add any comments on your own assessment of the study, and the extent to which it answers your question and mention any areas of uncertainty raised above.  

Exclude the relatively small sample size, the resource limitations would be another factor which affects the data collection. However, this study still shows the potential benefit of team-oriented care.
**Methodology Checklist 3: Cohort studies**

**S I G N**


Please note that a retrospective study (i.e. a database or chart study) cannot be rated higher than +.

### Section 1: INTERNAL VALIDITY

**In a well conducted cohort study:**

<table>
<thead>
<tr>
<th></th>
<th>Does this study do it?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.1</strong></td>
<td>The study addresses an appropriate and clearly focused question.</td>
</tr>
</tbody>
</table>

**SELECTION OF SUBJECTS**

<table>
<thead>
<tr>
<th></th>
<th>Does this study do it?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.2</strong></td>
<td>The two groups being studied are selected from source populations that are comparable in all respects other than the factor under investigation.</td>
</tr>
<tr>
<td><strong>1.3</strong></td>
<td>The study indicates how many of the people asked to take part did so, in each of the groups being studied.</td>
</tr>
<tr>
<td><strong>1.4</strong></td>
<td>The likelihood that some eligible subjects might have the outcome at the time of enrolment is assessed and taken into account in the analysis.</td>
</tr>
<tr>
<td><strong>1.5</strong></td>
<td>What percentage of individuals or clusters recruited into each arm of the study dropped out before the study was completed?</td>
</tr>
<tr>
<td><strong>1.6</strong></td>
<td>Comparison is made between full participants and those lost to follow up, by exposure status.</td>
</tr>
</tbody>
</table>

**ASSESSMENT**

<table>
<thead>
<tr>
<th></th>
<th>Does this study do it?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.7</strong></td>
<td>The outcomes are clearly defined.</td>
</tr>
<tr>
<td><strong>1.8</strong></td>
<td>The assessment of outcome is made blind to exposure status. If the study is retrospective this may not be applicable.</td>
</tr>
<tr>
<td>1.9</td>
<td>Where blinding was not possible, there is some recognition that knowledge of exposure status could have influenced the assessment of outcome.</td>
</tr>
<tr>
<td>1.10</td>
<td>The method of assessment of exposure is reliable.</td>
</tr>
<tr>
<td>1.11</td>
<td>Evidence from other sources is used to demonstrate that the method of outcome assessment is valid and reliable.</td>
</tr>
<tr>
<td>1.12</td>
<td>Exposure level or prognostic factor is assessed more than once.</td>
</tr>
</tbody>
</table>

**CONFOUNDING**

| 1.13 | The main potential confounders are identified and taken into account in the design and analysis. | Yes |

**STATISTICAL ANALYSIS**

| 1.14 | Have confidence intervals been provided? | Yes |

### Section 2 Overall Assessment Of The Study

| 2.1 | How well was the study done to minimize the risk of bias or confounding? | Acceptable (+) |
| 2.2 | Taking into account clinical considerations, your evaluation of the methodology used, and the statistical power of the study, do you think there is clear evidence of an association between exposure and outcome? | Yes |
| 2.3 | Are the results of this study directly applicable to the patient group targeted in this guideline? | Yes/ |
| 2.4 | Notes. Summarize the authors’ conclusions. Add any comments on your own assessment of the study, and the extent to which it answers your question and mention any areas of uncertainty raised above. | The percentage of “dropped out” subject was not clearly mentioned. Time frame might not be long enough and the severity of illnesses was not shown. |

Please note that a retrospective study (i.e. a database or chart study) cannot be rated higher than +.

## Section 1: INTERNAL VALIDITY

### In a well conducted cohort study:

<table>
<thead>
<tr>
<th></th>
<th>Does this study do it?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.1</strong></td>
<td>The study addresses an appropriate and clearly focused question.</td>
</tr>
</tbody>
</table>

### SELECTION OF SUBJECTS

<table>
<thead>
<tr>
<th></th>
<th>Does this study do it?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.2</strong></td>
<td>The two groups being studied are selected from source populations that are comparable in all respects other than the factor under investigation.</td>
</tr>
<tr>
<td><strong>1.3</strong></td>
<td>The study indicates how many of the people asked to take part did so, in each of the groups being studied.</td>
</tr>
<tr>
<td><strong>1.4</strong></td>
<td>The likelihood that some eligible subjects might have the outcome at the time of enrolment is assessed and taken into account in the analysis.</td>
</tr>
</tbody>
</table>
| **1.5** | What percentage of individuals or clusters recruited into each arm of the study dropped out before the study was completed? | Group 2003: 41.4%  
Group 2006: 37.3% |
| **1.6** | Comparison is made between full participants and those lost to follow up, by exposure status. | Yes |

### ASSESSMENT

<table>
<thead>
<tr>
<th></th>
<th>Does this study do it?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.7</strong></td>
<td>The outcomes are clearly defined.</td>
</tr>
<tr>
<td><strong>1.8</strong></td>
<td>The assessment of outcome is made blind to exposure status. If the study is retrospective this may not be applicable.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td><strong>1.9</strong></td>
<td>Where blinding was not possible, there is some recognition that knowledge of exposure status could have influenced the assessment of outcome.</td>
</tr>
<tr>
<td><strong>1.10</strong></td>
<td>The method of assessment of exposure is reliable.</td>
</tr>
<tr>
<td><strong>1.11</strong></td>
<td>Evidence from other sources is used to demonstrate that the method of outcome assessment is valid and reliable.</td>
</tr>
<tr>
<td><strong>1.12</strong></td>
<td>Exposure level or prognostic factor is assessed more than once.</td>
</tr>
</tbody>
</table>

**CONFOUNDING**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.13</strong></td>
<td>The main potential confounders are identified and taken into account in the design and analysis</td>
<td>Yes</td>
</tr>
</tbody>
</table>

**STATISTICAL ANALYSIS**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.14</strong></td>
<td>Have confidence intervals been provided?</td>
<td>Yes</td>
</tr>
</tbody>
</table>

**Section 2 Overall Assessment Of The Study**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2.1</strong></td>
<td>How well was the study done to minimize the risk of bias or confounding?</td>
<td>Acceptable (+)</td>
</tr>
<tr>
<td><strong>2.2</strong></td>
<td>Taking into account clinical considerations, your evaluation of the methodology used, and the statistical power of the study, do you think there is clear evidence of an association between exposure and outcome?</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>2.3</strong></td>
<td>Are the results of this study directly applicable to the patient group targeted in this guideline?</td>
<td>Yes/</td>
</tr>
<tr>
<td><strong>2.4</strong></td>
<td>Notes. Summarize the authors’ conclusions. Add any comments on your own assessment of the study, and the extent to which it answers your question and mention any areas of uncertainty raised above.</td>
<td>Univariate and multivariate analysis were mentioned which could provide more information for effects on independent variables.</td>
</tr>
</tbody>
</table>
**Appendix 5 - Level of evidence and grades of Recommendation by SIGN**

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1++</td>
<td>High quality meta analysis, systemic review of RCTs, or RCTs with a very low risk of bias</td>
</tr>
<tr>
<td>1+</td>
<td>Well conducted meta analysis, systemic review of RCTs, or RCTs with a low risk of bias</td>
</tr>
<tr>
<td>1-</td>
<td>Meta analysis, systemic reviews of RCTs, or RCTs with a high risk of bias</td>
</tr>
<tr>
<td>2++</td>
<td>High quality systemic reviews of case-control or cohort studies. High quality case-control or cohort studies with a very low risk of confounding, bias, or chance and a high probability that the relationship is casual.</td>
</tr>
<tr>
<td>2+</td>
<td>Well-conducted case control or cohort study with a low risk of confounding, bias, or chance and a moderate probability that the relationship is casual.</td>
</tr>
<tr>
<td>2-</td>
<td>Case control or cohort studies with a high risk of confounding, bias, or chance and a significant risk that the relationship is not casual.</td>
</tr>
<tr>
<td>3</td>
<td>Non-analytical studies, e.g. case report, case series</td>
</tr>
<tr>
<td>4</td>
<td>Expert opinion</td>
</tr>
</tbody>
</table>
### Appendix 6 – Grades of Recommendation

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>At least one meta analysis, systemic review, or RCT rated as 1++, and directly applicable to the target population: or A systemic review of RCTs or a body of evidence consisting principally of studies rated as 1+, directly applicable to the target population, and demonstrating overall consistency of result</td>
</tr>
<tr>
<td>B</td>
<td>A body of evidence including studies rated as 2++, directly applicable to the target population and demonstrating overall consistency of results; or Extrapolated evidence from studies rated as 1++ or 1+</td>
</tr>
<tr>
<td>C</td>
<td>A body of evidence including studies rated as 2+, directly applicable to the target population and demonstrating overall consistency of results; or Extrapolated evidence from studies rated as 2++</td>
</tr>
<tr>
<td>D</td>
<td>Evidence level 3 or 4; or Extrapolation of evidence from studies rated as 2+</td>
</tr>
</tbody>
</table>
Appendix 7 - Flow Chart of tracheostomy progression to decannulation

Eligible clients (Screened by work group members)

↓

Ensure haemodynamic stability
(Vital signs: GCS, BP, P, RR, SpO2 and body temperature), laboratory findings (e.g. ABG) and CXR

↓

Assess aspiration risk
(By using TOR-BSST©)

+/- Refer ST if query or reassessment is indicated

↓

Management of secretions
(Record characteristics of secretions and assess hydrational status)

+/- Refer PT for “Chest Physio”

↓

Cuff Deflation
(Provide suctioning for the client prior to deflating the cuff)

↓

Uses of Cuffless
(Change to dual-cannula cuffless tube by medical officers, i.e. “Shiley tube”)

↓

Capping Trials
(Leave tube capped if there is no signs or symptoms of respiratory distress)

+ Refer ST for providing speaking valve and speech training if client cannot tolerate

↓

Decannulation
(Indicated if client can tolerate capping for 48 hours)

(Daily cleansing should be provided to assess the stoma and promote wound healing)

Remarks
1. Explanation must be given to clients prior to each step
2. Proper positioning should be provided to ensure safety of clients, especially sitting up with good head, neck and trunk support
3. Equipment for emergency re-cannulation should be prepared at the bed side, which are similar to Appendix 9
## Appendix 8 - Equipment for opening of a tracheostomy (surgical approach)

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tracheostomy surgery set / Major set</td>
<td>Jackson-Burrows retractors</td>
</tr>
<tr>
<td>Tracheostomy tube (size and type to be determined by doctor)</td>
<td>Personal Protective Equipment (PPE) / sterile gowns / sterile gloves</td>
</tr>
<tr>
<td>Tracheostomy surgery set / Major set</td>
<td>Tracheal dilator</td>
</tr>
<tr>
<td>Disinfectant</td>
<td>Suction catheter (Fr 12)</td>
</tr>
<tr>
<td>Suture tray (with surgical blade and sutures)</td>
<td>Suction devices</td>
</tr>
<tr>
<td>Headlight / Portable surgery lam</td>
<td>Syringes (5ml / 10ml / 20ml)</td>
</tr>
<tr>
<td>Diathermy (optional)</td>
<td>Water soluble lubricant / K-Y jelly</td>
</tr>
<tr>
<td>Local anaesthesia (as prescribed)</td>
<td>Intubation equipment (standby)</td>
</tr>
<tr>
<td>Other drugs as prescribed (e.g. sedations / muscle relaxant)</td>
<td>Mechanical ventilator</td>
</tr>
</tbody>
</table>
Appendix 9 - Equipment used in changes of Tracheostomy Tubes

<table>
<thead>
<tr>
<th>Simple dressing set</th>
<th>Personal Protective Equipment (PPE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5% Chlorhexidine solution</td>
<td>KY jelly</td>
</tr>
<tr>
<td>Tracheostomy tube of the same size currently in place</td>
<td>Tracheostomy tube 1 size smaller currently in place</td>
</tr>
<tr>
<td>Syringes (10ml / 20ml)</td>
<td>Tracheal dilator</td>
</tr>
<tr>
<td>Key-hole dressing</td>
<td>Functional suctioning system</td>
</tr>
<tr>
<td>Suction catheters (Fr12 or Fr14)</td>
<td>Tracheal Mask</td>
</tr>
<tr>
<td>Oxygen</td>
<td>Tracheal Ties / Bands</td>
</tr>
</tbody>
</table>

Appendix 10 – The St. Mary’s Tracheostomy care Bundle Checklist

(Adopted from Cetto et al, 2011)

**Humidification** – Each client with a tracheostomy should receive adequate humidification, this should be documented 2 hourly.

**Tube patency/Inner tube** – Inner tube to be removed, checked for secretion build up, cleaned and replaced very 4 hourly

**Safety equipment** – All bedside equipment relating to tracheostomy care checked at the beginning of each shift

**Cuff** – Cuff status to be checked each shift

**Tracheostomy dressing/tapes** – To be changed at least daily

**Weaning plan** document and **care plan** are documented
## Appendix 11 – Information included in hand-off of clients with tracheostomy

<table>
<thead>
<tr>
<th>Date of tracheostomy performed</th>
<th>Type and size of tracheostomy tube</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cuffed or cuffless</td>
<td>Cuff status (inflated or deflated)</td>
</tr>
<tr>
<td>Cuff pressure (if inflated)</td>
<td>Characteristics of secretions: Viscosity, amount, color, odor</td>
</tr>
</tbody>
</table>
Appendix 12 - MC quiz. (Circle the most appropriate choice)

1. A systematic approach to tracheostomy progression begins by assessing which of the following?
   A. Cuff deflation has been tolerated for 24 hours
   B. Peak cough flow is at least 150L/min
   C. Ventilator support has been off for at least 48 hours.
   D. Vital capacity is at least 10mL/kg

2. Which of the following is **not** influenced by daily evaluation of the progress toward decannulation?
   A. Infection rate
   B. Overall cost
   C. Reduced length of stay
   D. Patient/family satisfaction

3. Which of the following statements is true regarding the cuff?
   A. An inflated cuff decreases the risk of aspiration
   B. Cuffs should not be deflated until ventilator support is ceased
   C. Patients should not be fed orally with the cuff inflated
   D. Secretions can be eliminated with an effective swallow

4. Which of the following should be considered when changing to a cuffless tube?
   A. A reusable inner cannula for patients with thin secretions
   B. The smallest inner diameter when breathing with an inflated cuff
   C. The narrowest feasible outer diameter if the tube will be capped
   D. Size 4 cuffless tube for thick, copious secretions
5. Which of the following is not a benefit of capping a tracheostomy tube?

A. Decreased volume of secretions  
B. Improved cough and swallow  
C. Promotion of comfort  
D. Restoration of speech

6. If a patient develops signs of respiratory distress during a capping trial, the first intervention should be which of the following?

A. Apply supplemental oxygen  
B. Provide ventilator support  
C. Remove the cap  
D. Suction the patient

7. Which of the following is not a benefit provided by a speaking valve?

A. Decrease pressure  
B. Minimized secretions  
C. Improved swallow  
D. Restored positive end-expiratory pressure (PEEP)

8. Which of the following is the recommended peak cough flow for successful decannulation?

A. 100 L/min  
B. 120 L/min  
C. 140 L/min  
D. 160 L/min
9. Which of the following is the recommended vital capacity for successful decannulation?
   A. 10 mL/kg
   B. 15 mL/kg
   C. 20 mL/kg
   D. 25 mL/kg

10. Which of the followings is the primary benefits of a tracheostomy button?
    A. Allows phonation
    B. Creates less secretions
    C. Is more comfortable
    D. Removes airway resistance

11. Which of the following statements is true about the tight to shaft (TTS) tracheostomy tubes?
    A. Air should be injected when the TTS cuff deflates
    B. A TTS tube decreases the risk of obstruction for thick secretions
    C. Sterile saline should be used to inflate the TTS cuff
    D. When inflated, the TTS cuff diffuses pressure across a small area

12. If there is difficulty with mucus plugging with a TTS tube, which of the following interventions should the nurse do first?
    A. Ensure the tracheostomy tube is changed promptly
    B. Increase the humidification
    C. Suction more frequently
    D. Provide pulmonary hygiene
Appendix 13 - Evaluation for work group members - Train-the-Trainer (TOT)

1. What are the three most important things you learned during this training?
   
   •
   
   •
   
   •

2. Please rate the course in terms of its impact and usefulness in the following areas, using the scale below. Circle the numbers that apply to your opinions.

   1 = Not useful at all                                5 = Very useful

<table>
<thead>
<tr>
<th>Area</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Useful in your daily work</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increasing your willingness to train and mentor others</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increasing your ability to train and mentor mentors</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. Do you think you will have the opportunity to utilize the training skills you have practiced during the workshop within the next six months?

   __ Yes      __ No

4. If yes, please briefly describe when and how you might apply these skills.

5. If no, please explain why you will not be able to utilize these training skills within the next six months.

6. If you were given the task of redesigning the workshop, what would you change?
Appendix 14 - Evaluation of ward nurses --Post-Training

1. What are the three most important things [or topics] you learned during the workshop?
   
   .
   
   .
   
   .

2. Was an appropriate amount of material covered during the workshop? If not, was too much material covered or too little?

3. To what extent do you think this workshop have made a difference in the way you handle clients with tracheostomy? (Circle the number)

   1     2     3     4     5
   No    Tremendous
   Difference    Difference

Comments: __________________________________________________________

_________________________________________________________________

_________________________________________________________________

_________________________________________________________________
Appendix 15 - Estimated man-hours for the management of tracheostomy decannulation in critically ill patients (12 month period)*

<table>
<thead>
<tr>
<th>Items</th>
<th>Item description</th>
<th>Time spent per item (Hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Registered Nurses in NS ward (n= 24)</td>
<td>Extra documentation time - 0.25 hour / tracheostomized client</td>
<td>9.5</td>
</tr>
<tr>
<td></td>
<td>Staff relieved from duty for training - 1.5 hour / nurse</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td><strong>Subtotal (A)</strong></td>
<td><strong>48.5</strong></td>
</tr>
<tr>
<td>Project Supervisor (n = 1)</td>
<td>Work meetings - 0.5 hour/ meeting - 15 meetings in total</td>
<td>7.5</td>
</tr>
<tr>
<td></td>
<td>Staff training@ - 1.5 hour / session - 6 nurses / session - 2 sessions attended (total)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Monitoring - 1 hour / week - 48 weeks (total)</td>
<td>48</td>
</tr>
<tr>
<td></td>
<td>Data analysis and report compilation - 5 bimonthly report - 1 final report</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td><strong>Subtotal B</strong></td>
<td><strong>93.5</strong></td>
</tr>
<tr>
<td>Work group members (n = 4)</td>
<td>Work meetings - 0.5 / meeting - 15 meetings in total</td>
<td>7.5</td>
</tr>
<tr>
<td></td>
<td>Staff training@ - 1.5 hour / session - 6 nurses / session - 1 session / coordinator - 4 sessions in total</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Monitoring - 1 hour / coordinator / week - 44 weeks (total)</td>
<td>176</td>
</tr>
<tr>
<td></td>
<td>Data entry - 0.5 hour / tracheostomized client</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td><strong>Subtotal C</strong></td>
<td><strong>215.5</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Total (A + B + C)</strong></td>
<td><strong>357.5</strong></td>
</tr>
</tbody>
</table>

* Calculation is based on the population size (n= 38) of tracheostomy done from Jan/2013 – Dec/2013

@ Training of the 24 nurses is distributed among project supervisor and work group members
Appendix 16 - Estimated cost for the management of tracheostomy decannulation in critically ill patients (12 month period)*

<table>
<thead>
<tr>
<th>Items</th>
<th>Time spent</th>
<th>Cost (HK$)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Running cost:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Staff cost: Project supervisor #</td>
<td>93.5 hours ($260 per hour)^</td>
<td>24310</td>
</tr>
<tr>
<td>Staff cost: Work group members ##</td>
<td>209.5 hours ($260 per hour)</td>
<td>54470</td>
</tr>
<tr>
<td>Staff cost: RN</td>
<td>9.5 ($165 per hour)^</td>
<td>1567.5</td>
</tr>
<tr>
<td>Staff training cost ###</td>
<td>36 ($165 per hour)^</td>
<td>5940</td>
</tr>
<tr>
<td>Training session by ST</td>
<td>6 ($317 per hour)^</td>
<td>1902</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>----</td>
<td>500</td>
</tr>
<tr>
<td><strong>Fixed cost:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medical equipment for tracheostomy management</td>
<td>-----</td>
<td>NS provision</td>
</tr>
<tr>
<td><strong>Other cost:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stationery©</td>
<td>-----</td>
<td>500</td>
</tr>
<tr>
<td>Printing and photocopying</td>
<td>-----</td>
<td>1000</td>
</tr>
<tr>
<td>Digital camera</td>
<td>-----</td>
<td>Available</td>
</tr>
<tr>
<td>USB (32GB)</td>
<td>-----</td>
<td>150</td>
</tr>
<tr>
<td><strong>Hidden cost:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conference room (for meetings, training sessions)</td>
<td>-----</td>
<td>NS provision</td>
</tr>
<tr>
<td>Cost of NS manager and doctors</td>
<td>-----</td>
<td>Not estimated</td>
</tr>
<tr>
<td>Cost of NS nurses in taking care of clients with tracheostomies</td>
<td>-----</td>
<td>Not estimated</td>
</tr>
<tr>
<td>Computer accessories and software</td>
<td>-----</td>
<td>NS provision</td>
</tr>
<tr>
<td><strong>Total estimated cost</strong></td>
<td></td>
<td>90339.5</td>
</tr>
</tbody>
</table>

* Calculation is based on the population size (n= 38) of tracheostomy done from Jan/2013 – Dec/2013
# One Advance Practice Nurse (APN) will be the project supervisor
## Four APN will be the work group members
### Staff training cost refers to the cost on relieving of nurses for training sessions
^ Hourly wages are calculated on the basis of mean salary from April/2015 (Appendix X to HR Circular 5/2015)
© Stationery refers to purchase of folders for filing of documents
**Appendix 17 - Estimated saving from the proposed management of tracheostomy decannulation (12 month period)**

<table>
<thead>
<tr>
<th>Items</th>
<th>Item description</th>
<th>Benefit (HK$)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Main Benefit</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Reduction in ICU length of stay (LOS) | - Cost: $23000 / day#  
- Mean reduction day: 12 | 276,000 |
| **Hidden Benefit** | | |
| Reduced in tracheostomy associated morbidity & mortality | ----- | Not estimated |
| Evacuation of ICU bed for admission of new patients & associated benefits | ----- | Not estimated |
| Enhanced staff knowledge, confidence and morale | ----- | N/A  
(base on qualitative data) |
| Retain of RNs | ----- | Not estimated |
| **Total estimate saving** | 276,000 |

* Calculation is based on the population size (n= 38) of tracheostomy done from Jan/2013 – Dec/2013  
# Hospital bed maintenance fee for ICU (The Government of HKSAR, 2013)
**Appendix 18**

**Gantt chart for implementation of the decannulation protocol over a twelve-month period**

<table>
<thead>
<tr>
<th>Task</th>
<th>Month</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="chart.png" alt="Chart Image" /></td>
<td></td>
</tr>
</tbody>
</table>

- Seek approval from administrators
- Involvement of colleagues (Marketing)
- Training the work group members
- Training ward nurses
- Pilot testing of the planning logistics
- Amend protocol & operational logistics as indicated
- Implementation of the practice in the unit
- Evaluation: patient outcome
- Evaluation: healthcare providers outcomes
- Evaluation: system outcomes