SOMERSET WEST
COMMUNITY
HEALTH
CENTRE

CAREGIVER'S GUIDE TO RESPIRATORY CARE IN THE HOME

ADULT

INTRODUCTION

Medically stable clients who require long-term ventilation, tracheotomy tubes, and oxygen often spend unnecessarily long periods of time in acute care and long-term hospitals due to a lack of support and resources within the community. This can be very discouraging for the client. It can also be a strain on the client and their family as well as the health care system. Clients who desire to return home must meet specific criteria to ensure a successful transition from hospital. These criteria include; a strong support network of friends and family who support this desire to return home, they must be considered medically stable, the ventilator settings are optimized, their most responsible physician (MRP) will provide medical support for ventilation in the community, and they have enough community home care hours required to support them at home. Once the criteria are met, the client should be considered a candidate to transition from the hospital setting to care at home.

There are a number of reasons clients should be supported to transition from the hospital to home. These include the rising cost of care within the hospital setting and the risk of infection. However; the most important reason is to improve the quality of life for long-term ventilated and/or trached individuals by empowering them to choose where they want to live and this choice should include their own home. For these reasons, the Champlain Local Health Integration Network (LHIN) is invested in helping clients transition smoothly from hospital to home by setting up the appropriate network of community supports and resources.

This caregiver manual was created following an identified gap in the training material available to families and caregivers of long term ventilated clients living at home within the Champlain LHIN. This resource was developed by Somerset West Community Health Centre (SWCHC) with funding from the Champlain LHIN and in collaboration with both adult and pediatric clinical experts in the area of home ventilation. The material you will find in this manual is for the medically stable, long-term ventilated and/or trached clients and their caregivers. This manual is to be used as a guide for caring for long term ventilation or trached clients in the home setting. By the time the client has returned home, education on equipment and other important procedures including suctioning and lung volume recruitment will have begun within the hospital setting to prepare everyone for success at home. Once the client is home, this guide will serve as an educational reference and will help to troubleshoot common problems you may encounter at home. This guide is meant to support you, the caregiver, in providing safe and effective care at home.

DISCLAIMER

The information found in this manual is intended for educational purposes only. The guide is not a substitute for clinical learning, hands-on training, or medical advice from your Doctor and/or Healthcare Providers nor is it meant to provide medical care. Medical advice should always be sought from your Doctor or Healthcare Providers. . As always, emergencies should be managed in the Emergency Department at your nearest hospital.

The mention of, or reference to, specific products, processes, or services, is not a recommendation or endorsement by Somerset West Community Health Centre, the Champlain LHIN or any contributors to this manual.

Please remember that 'Troubleshooting' guides provided in this manual are not substitutes for medical advice from a health care professional. Links to other websites or other sources that we provide also do not substitute for medical advice. When we have suggested an outside resource, such as a website or an organization, we are not assuming responsibility for the accuracy or appropriateness of the information contained on other sites, nor do we endorse the viewpoints expressed in other sources.

Please advise us of any areas that require revisions or updates.

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Ventilator Equipment Pool

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INTRODUCTION

ACKNOWLEDGEMENTS

DISCLAIMER

TABLE OF CONTENTS

1. AIRWAY AND BREATHING

A. The Normal Respiratory System
B. What happens when I breathe?
C. Baseline Vital Signs
D. Preventing Infection
   i. What can I do to Prevent Infections?
   ii. What is Pneumonia?
   iii. What are the signs of a Lung Infection?
   iv. What should I do if I suspect a Lung Infection?
   v. Washing your Hands at Home
   vi. Sterilizing Distilled Water
   vii. References

2. TRACHEOSTOMY AND TRACHEOTOMY TUBES

A. What is a Tracheotomy?
B. Why do I need a Tracheotomy (Trach) Tube?
C. Parts of a Trach Tube
D. Types of Trach Tubes
E. How do I know when I should replace my Trach Tube?
F. Where should I do my Trach Care?
G. Stoma Care
H. Trach Tube Care
I. Other information about Trach Tubes
J. Speaking Valves
K. Trach Kit
L. Special Considerations
M. Tracheal Suctioning
N. Other Helpful Tips
O. Changing the Trach Tube
P. Troubleshooting
Q. When to get support and contact information
R. How Do I Order Parts?
S. References

3. INTRODUCTION TO HOME VENTILATION

A. Why is Ventilation Needed?
B. Ventilation Basics and Terminology
C. Invasive and Non-invasive
D. Levels of Support
E. References

4. MECHANICAL VENTILATION

A. Home Ventilator Units: Trilogy
B. Ventilator Parts
C. Modes of Ventilation
D. Ventilator Settings
E. Ventilator Alarms
F. Ventilation Power Sources
G. The Ventilator Circuit
H. Testing the Ventilator Circuit
I. Ventilator and Ventilator Circuit Cleaning
J. Ventilator Safety
K. Troubleshooting
L. When to get support and contact information
M. How Do I Order Parts?
N. References

5. NON-INVASIVE POSITIVE PRESSURE VENTILATION

Bilevel

INTRODUCING THE OTTAWA HOSPITAL CANVENT PROGRAM

A. What is Bilevel
B. Why is Bilevel Needed?
C. Getting Started
D. Living with Bilevel
E. Bilevel Units
F. Bilevel Parts
G. Bilevel Modes
H. Bilevel Settings
I. Bilevel Alarms
J. Bilevel Power Sources
K. Cleaning
L. Troubleshooting
M. When to get support and contact information
N. How Do I Order Parts?
O. References

6. MOUTH-PIECE VENTILATION

A. What is Mouth-Piece Ventilation
B. Why is Mouth-Piece Ventilation Needed?
C. Getting Started
D. Living with Mouth-Piece Ventilation
E. Mouth-Piece Ventilators
F. Mouth-Piece Ventilator Parts
G. Mouth-Piece Ventilation Modes and settings
H. Mouth-Piece Ventilation Alarms
I. Trilogy Power Sources
J. Cleaning
K. Troubleshooting
L. Support & Contact Information
M. How Do I Order Parts?
N. References

7. OTHER EQUIPMENT AND THERAPIES

Manual Resuscitator Bags

A. Parts of the Manual Resuscitator
B. When do I use the Manual Resuscitator?
C. Testing the Manual Resuscitator
D. How do I use the Manual Resuscitator?
E. Cleaning the Manual Resuscitator
F. Troubleshooting
G. When do I get support and contact information
H. How Do I Order Parts?
I. References

Humidifiers

A. What do humidifiers do?
B. Types of humidifiers
C. Parts of the Pass-Over Heated Humidifier
D. Parts of the Heated Wire Circuit Humidifier
E. How do I use the Humidifier?
F. Cleaning the Humidifier
G. Troubleshooting
H. When do I get support and contact information
I. How do I Order Parts?
J. References

Pulse Oximeters

A. What is a Pulse Oximeter?
B. When do I use a Pulse Oximeter?
C. Pulse Oximeter Types
D. Parts of the Pulse Oximeter
E. Pulse Oximeter Parameters
F. How to apply the Pulse Oximeter
G. Pulse Oximetry Alarms
H. Power Sources and Battery Use
I. Cleaning
J. Troubleshooting
K. When do I get support and contact information
L. How Do I Order Parts?
M. References

Inhaled Medication

A. Types of Inhaled Medications and what They Do
B. Giving Inhaled Medications
C. How Do I Order Parts?
D. References

8. LUNG VOLUME RECRUITMENT AND PULMONARY CLEARANCE TECHNIQUES

A. Why is Lung Recruitment and Secretion Clearance Important?
B. Lung Volume Recruitment/Breath stacking
C. Cough Assist Device
D. Manually Assisted Cough
E. Suctioning
   i. When Do I Need to Suction?
   ii. Parts & Setting up Portable Suction Equipment
   iii. Tracheal Suctioning Procedure
   iv. Cleaning the Portable Suction Unit
   v. Suctioning On-The-Go
   vi. Other Helpful Tips
   vii. Troubleshooting
   viii. How Do I Order Parts?
F. References

9. EMERGENCY CONTACTS AND PLANNING

A. Personal Information & Records
B. Your Personal Support Network
C. Emergency Preparedness
D. Useful Web Resources
E. References

10. CAREGIVER'S ASSESSMENT

A. The Importance of the Caregiver's Assessment
B. Recognizing There is a Problem
C. Client Communication During Breathing Difficulties
D. Respiratory Failure
E. Signs of Breathing Distress
F. What Do I Do if the Client is in Breathing Distress?
G. References

11. CLIENT TRANSITIONS

A. Hospital to Home
B. Home to School or Work
C. Home to Hospital
D. End-of-Life Care

12. FUNDING COVERAGE OVERVIEW

A. Ventilator Equipment Pool
B. Equipment Provided by Home Care Vendors
C. What About the Remaining 25% Cost?
D. What About Masks for Positive Airway Pressure Therapy?
E. References

GLOSSARY OF TERMS

1. AIRWAY & BREATHING

A. THE NORMAL RESPIRATORY SYSTEM

The breathing system, or respiratory system, carries air into and out of the lungs. Oxygen rich air flows into the lungs and is sent to the body's cells to be used as fuel for energy and growth. Air leaving the lungs when you breathe out, or exhale, removes carbon dioxide, a waste gas, out of the body.

Components of the Respiratory System

1. Brain
2. Airway and Lungs
3. Chest Wall

Brain

- This is the breathing "command centre". The brain and nervous system respond to different signals in the body by sending signals to the respiratory system to start a breath.[1]
- A person with a brain injury or other diseases that affect the central nervous system function may not breathe as often or as deeply as they need to for the body to stay healthy.

Respiratory System

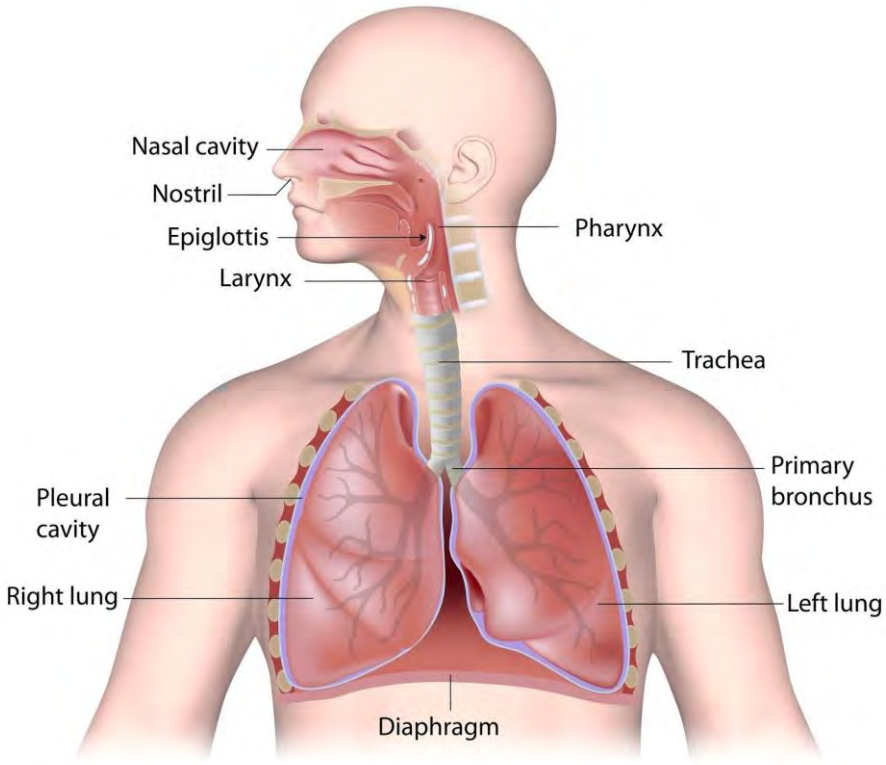


Figure 1. The Respiratory System
Alila Medical Media Shutterstock_228843244.jpg

Airway Anatomy and Function

The **nose** is the best way for air to enter your body and travel to the lungs. Air passes through the nose where it is filtered, warmed and humidified as it travels through the sinuses. Air can also enter the lungs through the mouth but this is not as effective at filtering and humidifying as the nose. The **mouth** is the passageway for food and air. The **pharynx** is the cavity at the back of the mouth and base of the tongue. The epiglottis covers the larynx during swallowing. The **epiglottis** prevents food and liquids from entering the trachea and lungs.

The **larynx** is the part of the airway that divides the upper and lower respiratory tract. The larynx contains the **vocal cords**. The opening between the vocal cords is called the **glottis.** Sound or voice is produced when the vocal cords vibrate as air flow out through the glottis during exhalation.

The ability to close the vocal cords is very important. This is the first step in generating a strong cough.

You need a strong cough to protect your lungs from infection.

When the glottis is closed, pressure can build in the lungs to create the strong, fast air flow needed to cough out unwanted dust, excess mucus or other irritants from the lower airway[3].

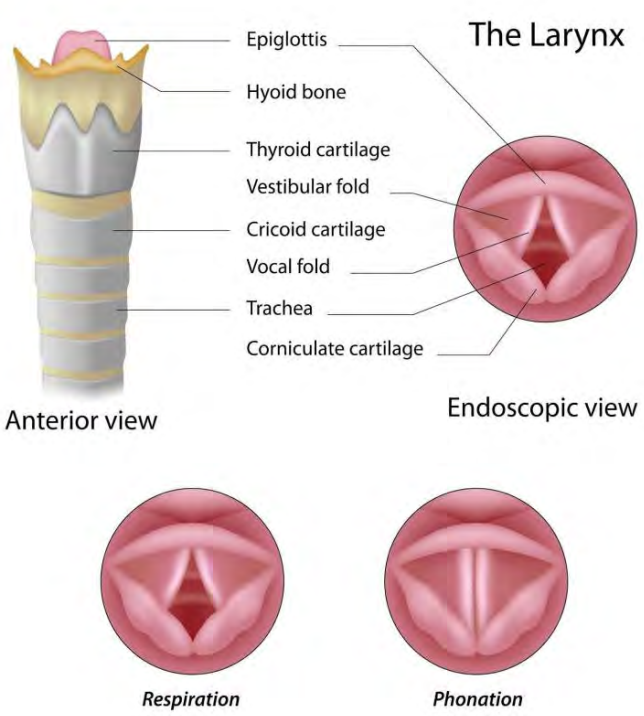
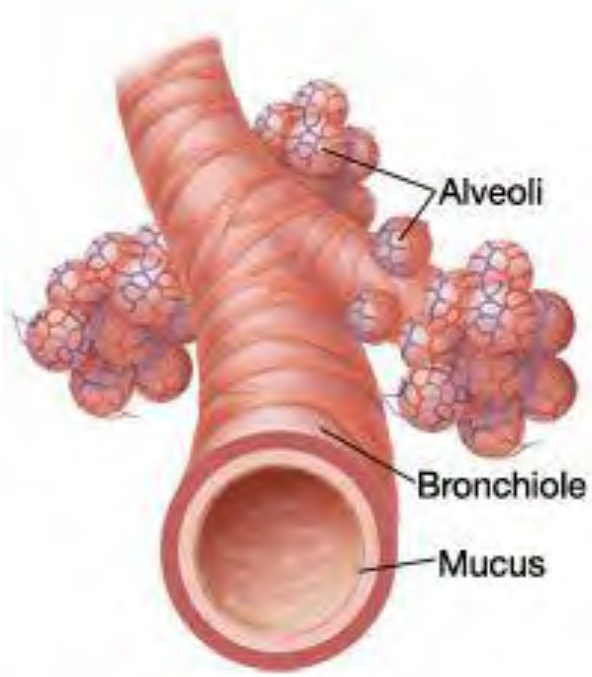


Figure 2. The Larynx
Alila Medical Media Shutterstock_118506337.jpg

The **trachea**, or windpipe, is the tube leading from the larynx to the lungs.

The trachea divides into two main branches or bronchi which direct airflow into the left and right lungs. The l**eft and right main bronchi** then branch into smaller and smaller airways called **bronchioles**.

The bronchioles continue to branch out through the lungs and deliver air to small sacs called alveoli. Bronchioles are lined with cells that produce mucus. **Mucus** is a sticky substance that acts to moisten the airway and works to trap dust, smoke and any other irritants from being breathed into the lungs.[4]



Gas exchange happens between the alveoli and the blood vessels surrounding them. Oxygen passes into the blood vessels that surround the air sacs. Blood then carries the oxygen throughout the body. As the body uses oxygen it produces carbon dioxide as a waste gas that the blood carries back to the lungs. Carbon dioxide leaves the body when we breath out. The body's need to take Oxygen into the lungs during the breath in is just as important as its need to remove Carbon Dioxide during the breath out.

Figure 3. Respiratory Bronchiole and Alveoli from Fairview Health Services www.fairview.org

To have good gas exchange (O2 breathed in and CO2 breathed out), there must be good ventilation.

B. WHAT HAPPENS WHEN I BREATHE?

Chest Wall

Chest wall movements allow for airflow in and out of the lungs. The expansion of the chest wall (and downward motion of the diaphragm) act to draw air into the lungs. Air leaves the lungs as the chest wall recoils and the diaphragm relaxes.

Diaphragm

The diaphragm is a muscle in the abdomen that helps with breathing by moving down during normal inspiration to create more space for the lungs to expand as air flows. As we breathe out, the diaphragm relaxes and moves back up.[5]

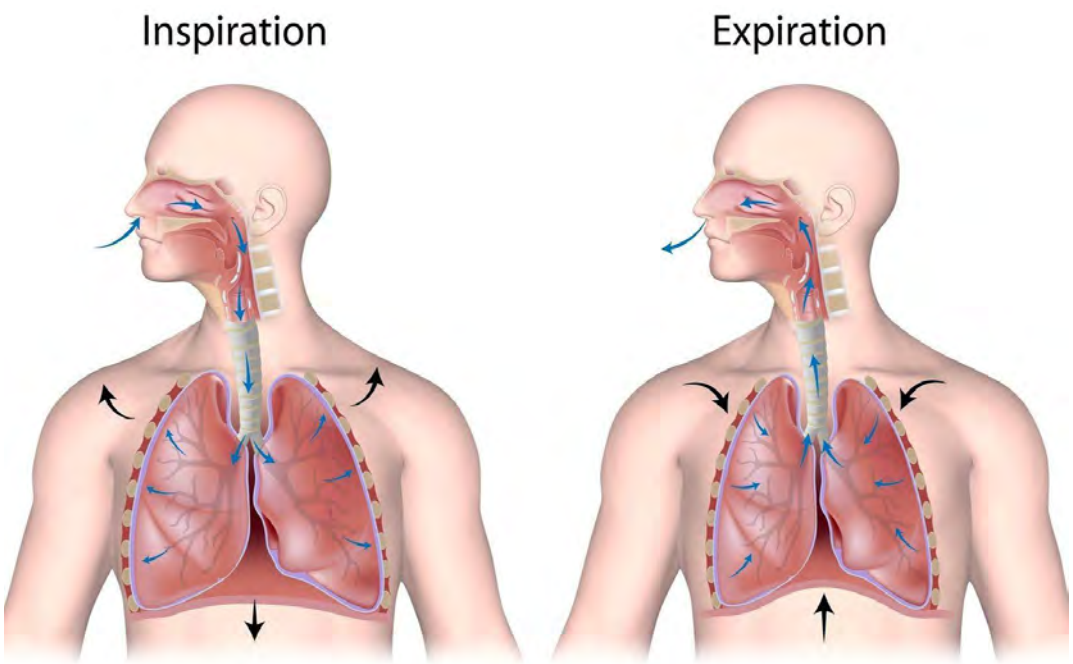


Figure 4. Breathing
Alila Medical Media shutterstock_228844606.jpg

Respiratory Muscles

The diaphragm is not the only breathing muscle. The intercostal muscles are located in between the ribs. These muscles help to take a deeper breath in by lifting the rib cage up and outward during inspiration. They also work to forcefully move air out during coughing or sneezing.

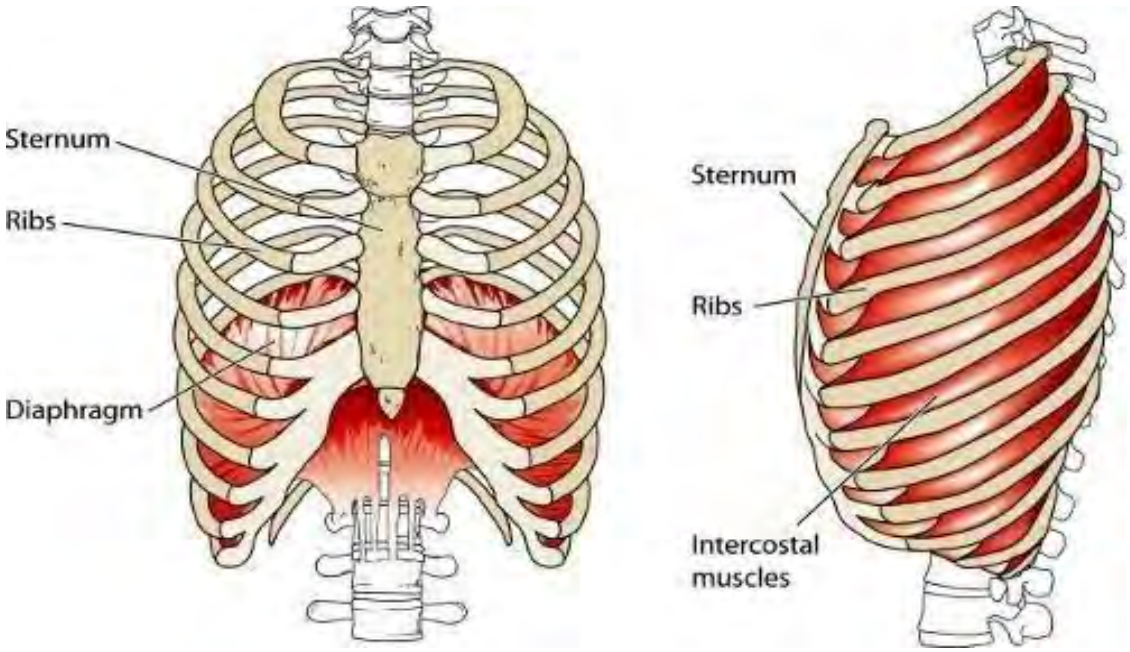


Figure 5. Muscles of Respiration
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C. BASELINE VITAL SIGNS

These measurements provide information about how your body is functioning. Note that your vital signs may change when you exert yourself, if you are sick and even when you feel strong emotions.[7] It is important to recognize abnormal vital signs and know how to respond.

Vital Sign	Normal Value
Heart Rate or Pulse	60-100 beats per minute (BPM)
Respiratory Rate	12-18 breaths per minute (BPM)
Blood Pressure	90/60 mmHg - 120/80 mmHg

The fourth vital sign is temperature. Normal body temperature ranges do not vary with age.[8] Try to use the same method each time you take your temperature so that you can compare each value.

Normal Temperature Range (‘Celsius)	
Method	**Temperature**
Rectal	36.6 - 38
Ear	35.8-38
Oral	35.5-37.5
Axillary	36.3-37.5

My Normal Vital Signs are:

Heart Rate: _____ **bpm**

Respiratory Rate: _____ **BPM**

Blood Pressure: _____ **mmHg**

Temperature: _____ **°C**

D. Preventing Infection

i. What Can I Do To Prevent Infections?

Figure 6. Hand washing
Yellow Cat Shutterstock 534507031

The Centers for Disease Control and Prevention state that hand washing as the "single most effective way to prevent the transmission of disease." [10]

Be sure everyone washes their hands often and keep hand sanitizer in convenient, easily accessible areas around your home and within reach of the client as much as possible.[10]

Using Hand Sanitizer[9]

Apply enough hand sanitizer on hands to cover all surfaces
Rub hands together, until hands feel dry, for about 20 seconds.
Do not rinse or wipe off the hand sanitizer before it is dry.

Figure 7. Hand Sanitizer
Marina Lohrback Shutterstock 162745193

Other important steps you can take to prevent infection at home include:[1]

- Keeping your home smoke free
- Asking friends and family to stay away if they have colds or the flu
- Any visitors with cold or flu symptoms who need to be near the client must wear a mask and wash their hands often
- Follow cleaning instructions for tracheostomy tubes, masks and all other respiratory care equipment

IMPORTANT! Following these instructions will help prevent serious infections and support a better quality of life.[10]

ii. What is Pneumonia?

Pneumonia is a lung infection where the lining of the airways becomes inflamed and swollen. This triggers cells in the airway to produce more mucus. This takes up valuable space for airflow to travel in and out of the lungs.[1] Clients requiring assisted ventilation are more susceptible to lung infections.[9] It is very important to recognize your symptoms and seek medical support as soon as you see the signs of a lung infection.

iii What Are The Signs Of A Lung Infection[1]?

- Increased cough
- Fever
- Feeling unwell and tired
- More shortness of breath
- Sense of chest heaviness or tightness
- Change in amount of secretions (thicker, coloured or smelly)
- Increased need for suctioning
- Increased need for puffers, if prescribed
- Smaller volumes of air delivered with breathing machine
- Higher airway pressures measured on breathing machine
- If you have a tracheostomy, the stoma may look red and swollen or even feel painful

iv. What Should I Do If I Suspect A Lung Infection?

If you suspect a lung infection call your healthcare professional or Doctor right away. Be sure to use your lung volume recruitment and airway clearance techniques as prescribed and increase frequency as directed by your lung action plan, if you have one. Refer to **Section 9: Emergency Contacts and Planning.**

You may also try to:

- Get more rest
- Take in plenty of fluids (by mouth or G-tube) unless fluids are medically restricted
- Use your breathing machine for longer periods of time, even during the day (if applicable)[10]

IMPORTANT! If prescribed an antibiotic, be sure to take the full course of medication, even if symptoms go away.

v. Washing Everyone's Hands At Home

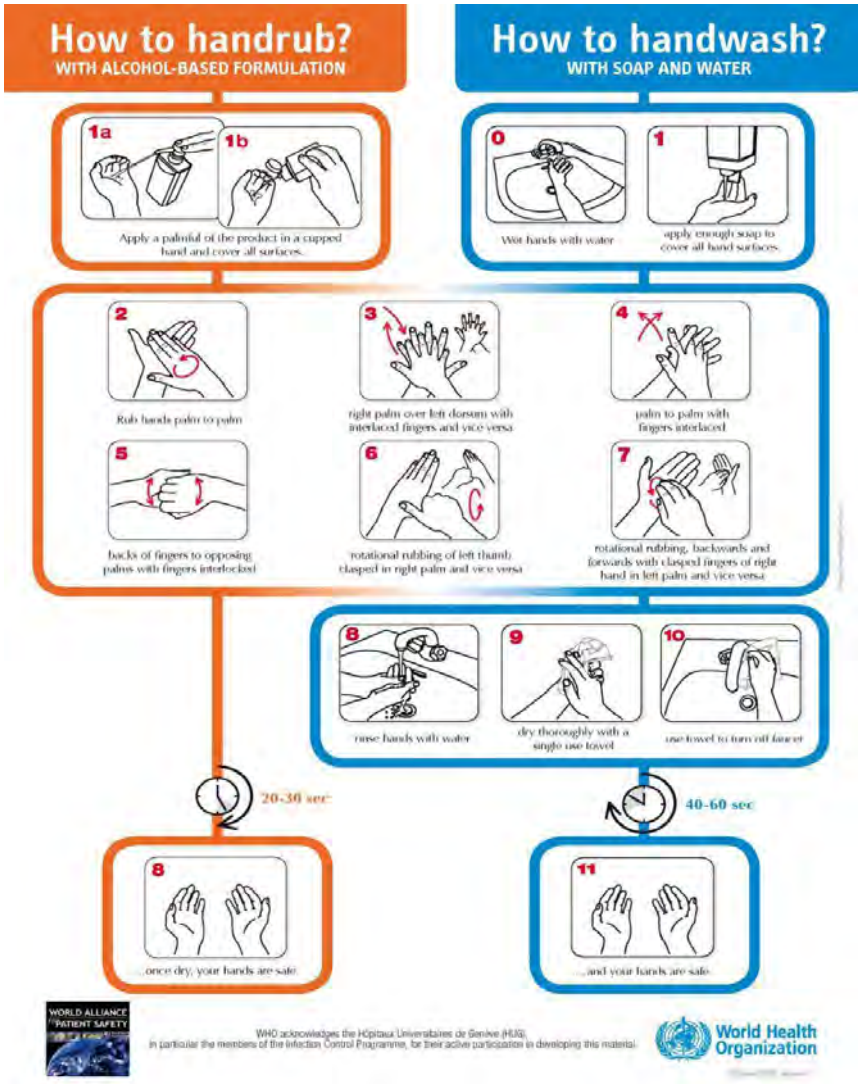

Figure 8. Hand Washing
Reproduced with Permission from the World Health Organization
Accessed on April 9, 2017 from http://www.who.int/gpsc/tools/GPSC-HandRub-Wash.pdf

vi. Sterilizing Distilled Water

You will need to have sterile distilled water on hand when you:

- Suction a tracheostomy tube
- Clean the stoma or tracheostomy opening
- Clean the inner cannula of a tracheostomy tube
- Fill the humidifier reservoir for your breathing machine

You may choose to buy sterile distilled water or you can boil distilled water at home to sterilize it.[1] Sterile distilled water is available to purchase at your home care company, local drugstore, or grocery store.

IMPORTANT! Use only distilled water that has been sterilized. This will kill any harmful germs or bacteria in the water that can cause lung infections [11]

How do I make sterile distilled water at home?[12]

- Use a pan large enough to boil water supply needed for 2- 3 days
- Use this pan for sterilizing distilled water only. Do not use for cooking.
- Bring distilled water to a boil and let boil for 5 minutes [13]
- Turn off heat and cover the pan.
- Water is ready for use once it is cooled.
- Place unused water in a clean container and seal, you do not need to refrigerate.

How To Sterilize Your Container:

- Place container in the water and boil for 10 minutes
- Turn off heat and cover the pan
- Keep the lid on the pain while the water is cooling. Do not use ice to cool the water

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2. TRACHEOSTOMY TUBES

A. What is a Tracheostomy?

A tracheostomy is a hole in your neck made by a surgeon that goes through your windpipe or **'trachea'**. The hole is called a **stoma.** This is where the **tracheostomy (trach) tube** is put into. You can breathe and cough through the trach tube as long as it is kept clear and not blocked.[1]

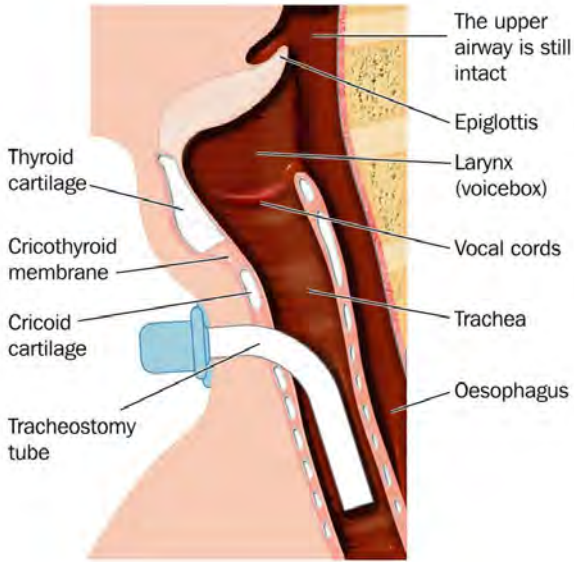

Figure 1 Tracheostomy Tube Side View

B. WHY DO I NEED A TRACHEOSTOMY (TRACH) TUBE?

There are different medical conditions that require the use of a trach or breathing machine, for an extended period, usually more than a few weeks. Here is a list of some of those medical conditions that require a trach and/or a breathing machine:

- Conditions that block or narrow your airway, such as vocal cord paralysis or throat cancer
- Paralysis, neurological problems, or other conditions that make it difficult to cough up secretions from your throat and require suctioning of the windpipe to clear your airway
- Neuromuscular diseases that make you unable to breathe well on your own.
- Other emergency situations when the airway is blocked and emergency personnel cannot put a breathing tube through your mouth and into your trachea[2]

A tracheotomy tube, or 'trach tube,' can either be cuffed or uncuffed. When a trach tube is cuffed it means that there is a balloon, or 'cuff,' attached to the bottom of the tube. When the cuff is inflated, or 'up,' it allows air to be breathed in and out of the trach tube instead of in and out of the nose and mouth. This means that air does not go through the voice box so you will be unable to talk when the cuff is up. An uncuffed trach tube does not have a balloon at the end of it. When the trach tube is uncuffed, air can go in and out of the trach tube or in and out of the nose and mouth. Because some air can go through the voice box and out the mouth with an uncuffed trach tube, often people will be able to talk while having a trach tube in. Sometimes a special speaking valve can be used to help with speaking. When a cuff is deflated, or 'down,' it behaves like a cuffless trach.[1(11)]

C. TRACH TUBE PARTS

The trach tube has the following parts:

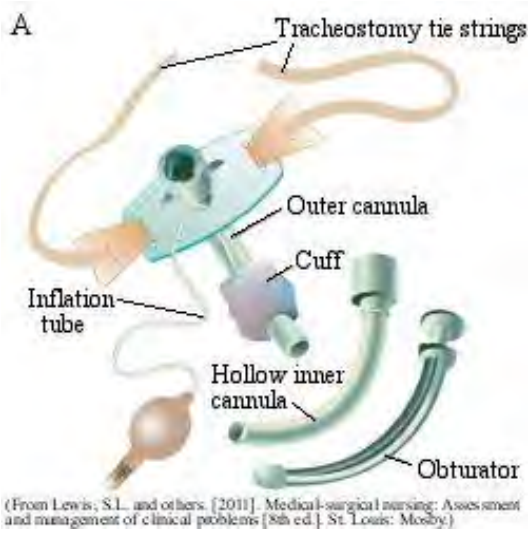

Figure 2.

Obturator (OB-ter-ay-ter)

The obturator fits inside your trach tube and helps the trach tube be placed into the opening in your throat. It is only used during trach tube insertion and trach tube changes. The obturator comes with your specific size of trach tube and should only be used for that size and type of trach that it came with. You must not use an obturator from one size trach tube to put in a tube that is a different size because it won't fit. [1(15)]

IMPORTANT! Keep the obturator somewhere where it is easy to find. If the trach tube falls out by accident, you need to use the obturator that came with that trach tube to put the trach tube back in.

Inner Cannula (CAN-you-luh)

This is a smaller tube that fits inside the trach tube. The inner cannula helps to keep your trach tube clean and clear. Mucus buildup may block your trach tube and the inner cannula. If this happens, the inner cannula can be removed quickly to help you breathe. Inner cannulas can be disposable or reusable. If you have a reusable inner cannula, you will be shown how to clean it. Don't worry if you do not have an inner cannula, as some trach tubes are not made to have inner cannulas (e.g. Bivona TTS). Ask your Nurse or Respiratory Therapist what type you have and how to take care of it.

Cuff (see also Section 2:I Other Information about Trach Tubes)

Trach tubes are made with and without cuffs. A trach is said to have a cuff if there is a balloon looking **Section** on the end of the tube. If there is no cuff, it is called a 'cuffless' trach tube.

Cuff Inflation Line or Pilot Line

This is a thin piece of tubing with a small balloon on the end that carries air or water to and from the cuff.

Flange or Neck Plate

The neck plate is the part of the trach tube that lies flat against the neck. There are slits on the side of the flange so you can attach trach ties to. Trach ties help keep the trach in place and prevent it from falling out. Often, the neck plate will have the brand and size of your trach tube printed on it. [1(16)]

Ties or Trach Holder

Ties are used to hold the trach tube to the neck so it will not fall out. There are various styles and material of ties such as foam, Velcro®, and twill. Care must be taken when putting the trach

ties on. They are not to be tied too tight or too loose. If you can fit one or two fingers between the trach ties and the neck then you have tied the ties correctly.

Cork

The cork is a cap for the opening of the trach tube. It can also be called a button, plug, or cork depending upon the type of tube. When the cap placed on the top of the trach tube, you cannot breathe in and out of the trach tube. When the cork is on the trach tube opening, air will be breathed in and out of the nose and mouth. The cork is only to be put on a trach after the cuff is deflated so that you can breathe around the trach tube and through the nose and mouth. If the trach is cuffless, or the cuff is deflated, and the cork is on, you may be able to talk.

IMPORTANT! Make sure the cuff is deflated, or in the "down" position before putting a cork on the trach. Take off the cork before you inflate the cuff.

D. DESCRIPTION AND TYPES OF TRACHEOSTOMY (TRACH) TUBES

Trach tubes are man-made airways that are made to fit into your windpipe through your neck.

There are many kinds of trach tubes. They can be made from different materials including: rubber, plastic, silicone, nylon, Teflon, polyethylene, metal, or most commonly, Polyvinyl Chloride (PVC). All trach tubes are made with non-toxic materials.

Everyone has a different sized neck, so the tubes come in different sizes. The length can vary from 5cm to 15cm and the width of the opening can vary from 2mm to 12mm wide.

Types of Trach Tubes

There are many kinds of trach tubes. Types of trach tubes include Portex, Shiley, and Bivona Tight To Shaft (TTS).

Portex and Shiley Tubes

These tubes are made of plastic and can come with or without a cuff. If these brands have a cuff, and the cuff is to be inflated, it is to be inflated with air. Some models have an inner cannula, some do not. The Portex Blueline Ultra tubes are colour coded. [3,4]

Figure 3

Figure 4

Figure 3 : Portex Tube Source:www.vitalitymedical.com/isroot/Stores/VitalityMedical/picxl/SPX505080.jpg

Figure 4 : Shiley Tubes Reproduced with permission from the American College of Chest Physicians (Pulmonary & Critical Care Updates; Vol. 18, lesson 15) www.chestnet.org/images/education/online/pccu/vol18/lesson15/Fig1.jpg

IMPORTANT! Always fill Portex and Shiley tube cuffs with air. Never fill with water.

Bivona TTS Tubes

A Bivona Tight-To-The Shaft (TTS) Tube is made of silicone and has no inner cannula.

An inflated cuff in a Bivona TTS trach tube is to be inflated with sterile, distilled water. When you remove the water from the cuff the cuff flattens so close to the trach tube that is almost invisible.[4]

Figure 5. Bivona Tubes Reproduced with permission from Smiths Medical North America http://www.smiths-medical.com/upload/products/mainImages/670180.jpg

Cleaning Bivona Tubes

You can re-sterilize these tubes up to 10 times by placing the tube in a pot of boiling water on the stove, then letting it cool before use. Due to the special coating on the tube called Superslick®, mucus rarely sticks to the inside of the tube.[4]

IMPORTANT! Only use sterile distilled water to inflate TTS tube cuffs. If you fill it with air, it will leak.

For your records, fill in the blanks and check the box with your trach information.

My trach type is: _____

My trach size is: _____

My trach has an inner cannula ❑ My trach DOES NOT have an inner cannula ❑

My trach has a cuff ❑
The cuff needs to be filled with _____ ml of air (Portex) OR
The cuff needs to be filled with _____ ml of sterile water (Bivona TTS)

My trach DOES NOT have a cuff ❑

Note: See your personal information for your tube type and size if unsure. If still unsure, ask your Doctor or Healthcare Provider.

E. HOW DO I KNOW WHEN TO REPLACE MY TRACH TUBE?

You need to replace your trach tube when:

- The trach tube is not centered in the opening in your throat
- The obturator is too tight
- The trach tube is 'off color' or it is close to 30 days
- The trach tube markings have faded [3]

Your Doctor will tell you how often your trach needs to be changed. For example, some people are to change their trach tubes once a month. Read the directions that are in the trach tube package.[1(13)] Ask your Doctor or Healthcare Professional if you are unsure how often you are to change your trach tube.

I am to change my trach tube every _____ and as needed.

IMPORTANT! Always have an extra trach tube of the same size and one size smaller with you at all times. Keep the obturator on hand at all times in case the trach comes out and you need to put it back in.[1(19)]

F. WHERE SHOULD I DO MY TRACH CARE?

Trach care can be done anywhere, but an area that is clean, private, and away from distractions is best. It should be done in a quiet place, free of interruptions like phones, and away from open windows, as well as heating ducts or fans to keep dust away.

Children and pets should not be allowed in this room as they can bring in dust, dander, and germs.

Your room should have:

- A mirror
- Good lighting
- A comfortable spot to sit or lie down
- Shelves or large drawers for all your supplies. Keep these areas clean.

When doing trach care, it is best to do the care at the same time every day. Usually, 20 to 45 minutes is needed to complete the care.

IMPORTANT! If you have any questions, ask your doctor.

G. STOMA CARE

The trach tube is placed inside the hole in your throat and this hole is called the 'stoma'. Stoma care refers to the cleaning of the skin around the opening in your throat. When stoma care is done often and well, it will help prevent infections. Do your stoma care at least once a day. First thing in the morning or just before going to bed are good times. If you find that the area around the stoma is swollen, red or tender to the touch, you may have to do the cleaning more frequently.[1(20-21),4 (10-11), 10 (10)]

How do I clean the stoma?

Supplies

- Sterile distilled water (or sterile normal saline)
- Cotton tipped swabs or gauze
- Sterile trach dressings
- Disposable cups for water
- Suction equipment
- Disposable gloves

Technique

1. Wash hands well
2. Put on clean gloves
3. Make sure you are in a comfortable position and can see the trach area easily. You may find using a mirror helpful
4. Suction, if needed

IMPORTANT! Make sure the trach tube is stable and not at risk of falling out during the cleaning process.

5. Take off the old dressing and throw it in the garbage. Pay attention to the colour of the mucus, the amount of mucus, and if there is any unpleasant smell.
6. Check the skin around the trach opening (stoma) every day for signs of an infection.
7. Watch for:
   - Redness or swelling
   - Creamy yellow or green mucus
   - Crusting, dry mucus
   - An unpleasant smell
   - Pain or tenderness around the stoma
   - Any extra tissue growth

   Take note of any differences and report them to your healthcare professional.

8. Dip a cotton swab or gauze in sterile distilled water and clean the area around the opening, gently removing any dried mucus.
9. Clean the skin opening and then outward in a growing circle. See image below for swab technique.

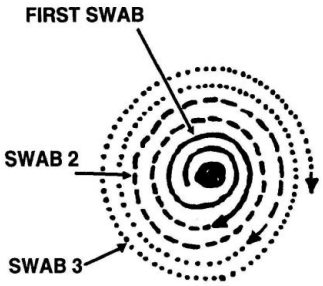

Figure 6.
http://nursing411.org/Courses/MD0540_Sterile_Procedures/4-06_Sterile_Procedures.html

Check to see that the opening is not bigger than usual. Tell your Doctor or Healthcare provider if so. Throw away each swab or gauze after use.

10. Dip a new cotton-tipped swab or gauze in sterile distilled water and clean/rinse the area.
11. Dry with fresh applicator swab or gauze.
12. Put on the sterile dressing being careful not to twist the trach tube or pull on the flange.
13. Change trach ties when they are dirty or when the Velcro® is no longer holding properly.
14. Pour the water into the toilet and clean the containers.
15. Take off gloves and wash hands well.
16. Gather clean supplies so they are ready for the next cleaning.

IMPORTANT! Dirty swabs and dressings may cause infections so they should be thrown away carefully. Wrap them in a plastic or paper bag and then put them in the garbage.

H. TRACH TUBE CARE

How do I clean my inner cannula and cork?

If you have a trach that has an inner cannula, you may need to clean or replace the inner cannula daily. If you have a lot of mucus that clogs your inner cannula, you may have to clean or replace the inner cannula more than once a day. When you keep the inner cannula clean, you will help prevent a lung infection. [1(22-26), 6]

Daily Cleaning

Supplies

- A clean inner cannula, cork or speaking valve
- Cotton tipped swabs or gauze
- Tweezers
- Pipe cleaners
- Clean small plastic bags or dry container
- Suction machine and supplies
- Disposable gloves
- Two covered containers to be numbered and labeled

Technique

1. Label the containers #1 and #2 to avoid mixing up the clean and dirty containers.

2. Container #1 is for the dirty cannula and corks. Pour hydrogen peroxide or sterile distilled water into this container.

3. Container #2 is to rinse the cleaned cannula and corks. Pour sterilized distilled water into this container.

4. Wash hands well and put on clean gloves.

5. Make sure you are in a comfortable position. Make sure you can see the trach area easily. You may find using a mirror helpful.

6. Suction, if needed.

7. Remove the dirty inner cannula, the cork or speaking valve from the trach tube and place it into container #1 (hydrogen peroxide or sterile distilled water).

8. Put in a clean inner cannula, cork or speaking valve and lock in place.

9. Remove the dirty cannula from container #1 with tweezers and clean with a cotton swab, gauze, or pipe cleaners. Do not scrub.

10. Look for cracks or breaks in the tube and locking mechanism. If there are cracks or breaks, the trach tube needs to be changed.

11. Place the cannula in container #2 (sterile distilled water) and rinse well.

12. Remove the cleaned cannula from container #2 (sterile distilled water) with the tweezers.

13. Dry the outside of the inner cannula with clean dry gauze. Tap it against the gauze to remove any drops of water from inside the cannula.

IMPORTANT! Do not whip or shake the cannula to remove drops as this can spread drops and their germs into the air.

14. Store the now clean inner cannula in a small clean plastic bag or dry container.

15. Throw out all soiled supplies, along with the dirty distilled water and hydrogen peroxide.

16. Wash all containers in soap and water. Rinse well. You can wash the containers on the top shelf in the dishwasher.

17. Take off gloves and wash hands well.

18. Get clean supplies ready for the next use.

IMPORTANT! Be sure to change the distilled water and hydrogen peroxide every day!

Weekly Cleaning

Soak each container and lid in a solution of 1 part vinegar and 3 parts water for 20 minutes. Rinse and let air dry.

How do I clean a metal or silver trach tube?

Hydrogen peroxide can damage these tubes. If you have a metal or silver trach tube, ask your Respiratory Therapist for cleaning instructions.

How do I change my trach ties?

It is important that trach ties are kept clean and dry because it will prevent skin irritation, sores and infections on the neck area.

The only thing holding your trach tube in place are the trach ties. If the trach ties are too loose or off, the trach could come out. These ties are usually made of cotton or cloth with a Velcro® closure.

Having two people do the trach tie change is best as it may help prevent the trach tube from falling out by accident. One person holds the trach in place while the other changes the ties and makes sure the skin around the stoma is clean and not showing signs of infection. If you are doing a trach tie change by yourself, tie on the clean new ties first before removing the old ties. This helps ensure that the trach tube is always held securely in place.[2]

Change the tie tapes daily and as needed

Supplies

- New trach tube ties
- Clean gloves
- Ask second person to assist, if available
- Tweezers
- Scissors
- Suction machine and supplies
- Tracheostomy Kit

Technique

1. Sit in a comfortable position. Make sure you can see the trach area easily. Using a mirror is helpful.
2. Wash hands well and put on clean gloves.
3. Have the second person hold on to the trach tube by gently holding onto the edges of the flange.

4. Cut and remove the dirty trach ties. If you have a pilot line on the cuff, take care that you do not cut the pilot line by accident.
5. Put one end of the clean trach tie through the hole on one side of the flange. Use the tweezers to pull the trach tie through the hole.
6. Pull the ends of the ties so they are even.
7. Bring both pieces of the ties around the back of the neck to the other side of the trach flange.
8. Using tweezers take one end of the tie and pull it through the hole on one side of the flange.
9. Bring the ends of the tie to the side of the neck and tie them in a knot.
10. Do not tie them too tightly. Allow enough space for 1-2 fingers between your neck and the trach ties. To check this, place 1 or 2 fingers under the tie at the side of the neck, your fingers should fit snugly under the tie.
11. Take off gloves and wash hands [1(24-26), 4 (12-13), 7, 10 (9)]

I. OTHER INFORMATION ABOUT TRACH TUBES

What is a cuff?

The cuff is a balloon found at the end of the trach tube. When the balloon is inflated, it fills the space between the trach tube and the windpipe. An inflated cuff may be needed if you are using a breathing machine, or if suctioning is required. If the cuff is not inflated, air can pass around the outside of the trach tube up through the voice box so you can speak.

The cuff is inflated by putting either air or water in through the pilot line. If you have a cuffed Shiley or a Portex trach tube, you will fill the balloon with air. If you have a Cuffed Bivona TTS Tube, you will fill the balloon with distilled water.

The pilot balloon on the inflation line shows whether the cuff is 'up' or 'down'. The pilot balloon does not tell you how much air or water is in the cuff. Ask your Respiratory Therapist or Nurse how much air or water needs to be in your cuff.[1(27), 4(9), 8]

IMPORTANT! Make sure that you know how much air or sterile water needs to go into your cuff. Ask your healthcare professionals to show you how.

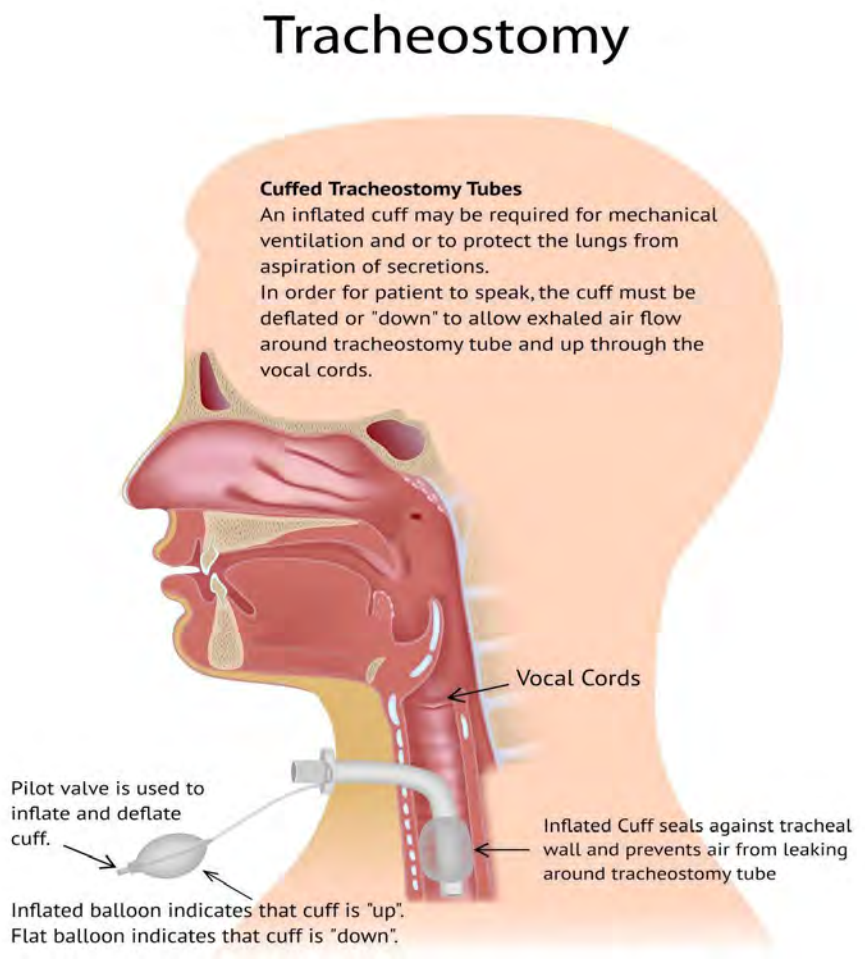

Figure 7: Cuffed Tracheostomy Tube
Alila Medical

Deflating the Cuff (Putting the Cuff "Down")

1. Suction the mouth, if needed.

Note: Sometimes mucus sits in the throat or on top of an inflated cuff. When the cuff is deflated, this mucus can fall from around the cuff into the lungs making you cough. It is a good idea to have a suction catheter ready so you can suction right away if this happens.

2. Using a 10cc syringe without a needle attached, push the plunger in all the way and attached it to the cuff line

3. Slowly pull the plunger of the syringe back until the plunger can no longer be pulled back any further and the balloon on the cuff pilot line is flat

4. You have now deflated the cuff [1(27)]

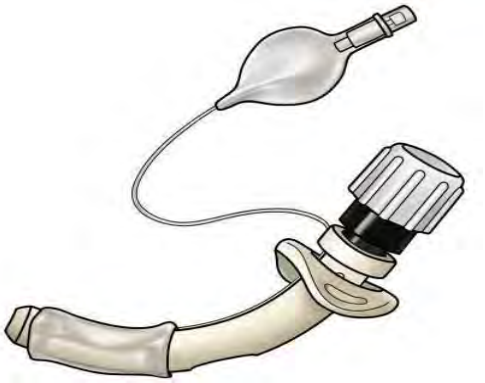

Figure 8. Janet Fong, June 2008. Fenestrated cuffed curved double lumen tube with fenestrated inner tube and external orifice occluded.
https://www.aic.cuhk.edu.hk/web8/Fenestrated%20Shiley%20with%20fenestrated%20inner%20tube.jpg

Inflating the Cuff (Putting the Cuff "Up")

1. Pull the syringe plunger back to the desired 'ml' marking on the syringe.
2. Attach the syringe to the pilot line and push the air or water into the pilot line slowly so that the balloon inflates
3. Remove the syringe from the pilot line [1 (27-28), 8]

IMPORTANT! Never add air to a cuff that already has air in it.

Figure 9. Shiley™ XLT Extended-Length Disposable Inner Cannula Tracheostomy Tube.
http://www.medtronic.com/covidien/products/tracheostomy

If there is a leak around the cuff, see "How do I fix a Cuff Leak?" question below

IMPORTANT! If the cuff is filled with too much air or water, it will cause damage to the trachea. Do not over inflate the cuff.

How do I fix a cuff leak?

First you want to make sure that there is a leak. You will take out all of the air or distilled water from the cuff. Reinflate the cuff with the correct amount of air (or water) and wait. If after several minutes there is still a leak then:

If your cuff is filled with air you can check if there is a leak by putting the pilot balloon in a small cup of water while it is inflated. If there are bubbles coming out of the balloon there is a leak and the trach tube needs to be changed.[1 (28)]

I have tried everything and there is still a leak in the cuff, what do I do now?

If you have been given directions on how to do a trach change, and you are comfortable doing it, then change the tube. If you have not been told what to do, or you are not comfortable, call your Respiratory Therapist for help. If no one is available to help, go to the nearest emergency room.

J. SPEAKING VALVES

IMPORTANT! You must make sure that your trach cuff is down and deflated before using a speaking valve. You must always take off the speaking valve before putting the cuff up.

A speaking valve is a one-way valve that is placed on your trach tube and allows air to go into your trach and lungs but does not allow air to come out of the trach. Instead, the air comes up from the lungs, past the trach, and through your voice box. Air going through your voice box makes it possible to talk.

There are many brands of speaking valves, but the Passy Muir valve is the most common.

Speaking valves can improve:

- Swallowing: You will be less likely to choke on your food
- Smelling: You will smell your food and improve your appetite
- Coughing: You will have a stronger cough and will not need to be suctioned as often [1(29), 9]

Special Considerations

The speaking valve sometimes pops off, especially with coughing, so make sure it is on well. It can be kept on the trach tube with a fastener.

Remove the speaking valve when:

- You are ready to sleep
- Having an aerosol treatment
- Or need to be suctioned

IMPORTANT! Never use a speaking valve when the cuff is “up” or in the inflated position.

Figure 10 : Passy-Muir® Tracheostomy Speaking Valve picture from http://mcarthurmedical.com/product/passy-muir-valve-venttrach-spk-valve

How do I clean my speaking valve?

The valves will last a long time if taken care of.

Clean the speaking valve every day using a mild soap and warm water. Rinse well. Allow to air dry. Once it is dry, keep it in a clean and closed plastic container.[1(30), 9]

Some cleaning products will damage the valve.

Do not use the following cleaning products on your speaking valve:

- Hot water or harsh chemicals
- Hydrogen Peroxide, bleach
- Alcohol
- Cleaning brushes

K. EMERGENCY TRACH KIT

Carry a kit containing these basic supplies:

- Trach tube of current size
- Trach tube that is half a size smaller than the current one
- Obturator
- Trach ties or velcro ties
- Water soluble lubricant
- Normal saline nebules
- Trach gauzes
- Scissors
- Portable suction unit (charged)
- Suction catheters
- Suction tubing
- Manual Resuscitator Bag
- Oximeter with probe (optional)

You should also carry a copy of personal information with the emergency trach kit (See **Section 9: Emergency Contacts & Planning**).

L. SPECIAL CONSIDERATIONS - LIVING WITH A TRACHEOSTOMY

Humidification

Drink plenty of fluids such as water and juice (8-10 glasses a day) unless your Doctor tells you differently. Use a humidifier at home and clean it regularly.

Bathing

Do not allow water to enter the trach. Make sure the shower sprays below your chest level, shield the tube with a shower guard or mask, or use a trach plug if tolerated. Shield the tube from powder, hair spray, or perfumes. Do not go in water above your chest

Clothing

Avoid clothing that blocks the trach tube. Avoid clothing that sheds fibers (e.g. angora. Wool sweaters) that could get breathed in. Avoid necklaces, medallions, or small objects on strings around the neck that could fit into the trach tube opening.

Environment

Lightly cover the trach tube with a scarf, kerchief, or gauze in cold weather or windy days. Avoid dust, mould, and smoke from tobacco or other types of smoke. Avoid fumes from cleaning solutions such as ammonia, bleach, furniture polish, or other strong smelling products. Try to dust with a damp cloth and vacuum regularly to keep the house clean and get rid of dust[4 (26), 10 (5)]

M. TRACHEAL SUCTIONING (FOR MORE INFORMATION ON SUCTIONING, SEE ALSO Section *8E.)*

Suctioning removes mucus from the trach tube and helps keep it clear so you can breathe easily. Suctioning is done with a smaller tubing called a suction 'catheter.' The catheter fits inside your trach tube.

My suction unit pressure is set at: _____
(Normal suction pressure range for adults is 80-120mmHg)

Size of suction catheters to be used is: _____ French

Figure 11: Devilbiss Home Suction Machine
http://www.devilbisshealthcare.com/products/suction-therapy/homecare-suction-unit

NOTE: The following steps for suctioning are for the person doing the suctioning procedure.

Suctioning is considered a **clean** process and you want to keep the area and procedure as clean as can be. It is not a sterile procedure.
You or the person doing the suctioning may wear masks and gloves so that the mucus and germs are not spread to them.[1(33-37),10(7-8)]

IMPORTANT! Check your suction equipment every day; it must always be ready to use.

1. You will need:
   - Suction machine – electrical or portable
   - Suction tubing
   - Sterile Distilled water (flushing solution)
   - Clean container for flushing solution
   - Disposable suction catheters of correct size
   - Clean disposable gloves

- Hand sanitizer
- Manual resuscitation bag with flex hose and trach adapter, if needed
- Extra inner cannula, if needed
- Obturator
- Suction unit plug and charger, if needed
- Plastic bag for disposal of materials

2. Wash hands well

3. Fill the container with sterile distilled water

4. Attach the suction catheter to the connecting tubing of the suction machine

5. Turn on the suction machine and be sure there is good suction and that the suction pressure is at the right setting

6. Make sure the person you will be suctioning is in comfortable position. Their head should be above their shoulders

7. Put on clean gloves being careful not to touch anything except the catheter

IMPORTANT! Use a clean suction catheter for each suction session.

8. Withdraw the catheter from package slowly. Hold the catheter with your gloved hand 10 to 15 cm (4 to 6 inches) from the tip

9. Remove the cork, trach mask, ventilator or manual resuscitator bag from the trach, if needed

10. Gently put the catheter 4 to 5 inches into the trach opening. Stop if there is resistance or if there is a cough. It is normal for someone to cough when they are being suctioned. But not everyone will cough

IMPORTANT! Do not push or force the catheter. You could cause damage. Be gentle.

11. If you hit resistance, pull out slightly

12. You are now ready to apply the suction. Cover the thumb hole on the catheter and slowly take the catheter out while twisting, or 'rolling' it between your fingers. You can pull the catheter straight out or roll it back and forth between your fingers. It all depends on what works best to remove the mucus. It takes practice to find what works best to remove the mucus

IMPORTANT! Do not cover the thumb hole on the catheter until you are ready to suction. Suction only when you are removing the catheter.

IMPORTANT! The suction catheter should not be in the trach for more than 20 seconds.

13. Rinse the catheter out by dipping the catheter tip into sterile distilled water and suction water through the catheter and suction tubing until it is clear. You can use the same catheter to suction a few times, as long as it is kept clean. But, if the catheter becomes blocked with mucus, remove it and use a new catheter

14. Ask the patient “Do you need to be suctioned again?” Suctioning is needed if you hear “gurgling” sounds during breathing. Repeat steps 10 to 14, if more suctioning is needed

15. Note: Suctioning can cause the patient to feel very short of breath. So take breaks between suction attempts. You may need to place the patient back on ventilator for a while or give them some manual breaths with the resuscitation bag in between the suctioning sessions

16. Look at the mucus being suctioned out. Take note of the amount, the colour, the thickness and the smell

17 When you are finished suctioning, put the cork, trach mask or ventilator back on the trach tube, if needed. Be sure to replace the cork/speaking valve and/or the heat and moisture exchanger (HME) after the suction session

18. Coil or wrap the suction catheter around the fingers and palm of one hand, then pull the cuff of the glove over the top of the coiled catheter to completely cover it. Throw out the gloves and dirty catheter. Throw out the suction catheter after each suction session

19. Turn off the suction unit

20. Empty and clean the suction drainage bottles and containers, if needed

21. Wash hands well

22. Be sure the suction equipment and supplies are ready for the next use. You never know when you will need it in a hurry so you will want it to be ready to use.[1(33-37),10(7-8)]

When should I suction?

Most people are to be suctioned when needed. This might be once or twice a day or sometimes more frequently, especially if they have an infection. You will make it a part of your daily routinely such as first thing in the morning, or just before going to sleep at night.

Suctioning may help if:

- You are unable to cough the mucus up and out
- You are on a breathing machine (ventilator) and the airway pressures are higher than usual
- You are having trouble breathing

Why does the person feel so short of breath when they are suctioned?

When you are suctioned the catheter removes the mucus and some of the air from the lungs. Because it removes some air from your lungs, it may cause shortness of breath. For this reason, try to keep the suction time to less than 20 seconds and rest between each suction. You can also use a manual resuscitator, before and after suctioning. This often helps you feel less short of breath and may help move the mucus up further so the suction catheter can then take it out.

Why is blood coming up the suction tube?

You may see blood when you suction. This can be very normal if there is mucus coming away

from the lung wall. This may also happen if the suction catheter is too large or if you are too rough with the catheter when putting the catheter into the airways.

You should not have any bleeding if you always put the suction catheter in gently.[1(36),10(7-8)]

Suctioning on the go

Before going out, make sure the portable suction unit is fully charged and you have all your suction supplies.
Portable suction supplies:

- Suction catheters
- Connecting tubing
- Gloves
- Masks
- Hand sterilizer
- Distilled water, if desired
- Spare inner cannula, if applicable
- Manual resuscitator
- Trach Kit

N. OTHER HELPFUL TIPS

You should only use one suction catheter per suction session. If the catheter becomes clogged, and you are unable to suction water into the tubing, throw it out. Replace it with a new catheter. Sometimes it is helpful to give a few breaths through a resuscitation bag before and after the suctioning which may help move mucus higher in the airway and help with breathing.

O. CHANGING THE TRACH TUBE

If you have been trained to change your own trach tube you may change it on a schedule decided on by you and your Doctor. Some people change their trach tube once a month, others change it more often. Some will change it if it becomes plugged or falls out by accident. It is important that all family members are familiar with how to change your trach in case of an emergency, such as it becoming plugged or falling out.[1(38-40) 4(18-19)]

For a trach change, it is best if you have a second person to help you.

1. You will need:
   - Clean or new trach tube with obturator; same size as the one that is currently in
   - One size smaller trach tube – in case of an emergency where you cannot get the new same size tube in
   - Trach ties
   - Supplies to clean the stoma
   - Syringe (if the tube is cuffed)
   - Scissors
   - Sterile distilled water
   - Manual resuscitation bag and mask
   - Water soluble lubricant
   - Suction machine (charged) and suction catheters

2. Wash your hands well and put on clean gloves

3. Check the new trach tube:
   - Remove the trach tube from the package
   - Look at the new tube. If you notice any cracks or breaks, get a new tube
   - If there is a cuff on the tube, check that it is working by inflating it and deflating it. Inflate the cuff with air or water, as ordered by your Doctor. If you notice a leak, get another tube. If there are no problems, deflate the cuff completely

4. To keep the tube as clean as possible, touch only at the flange

5. Put the obturator into trach tube

6. Lubricate the end of the trach tube with a water soluble lubricant

7. Make sure the person is comfortable and lying on their back with their neck tilted slightly back. To do this, some people find it helpful to put a rolled towel under their shoulders

8. Do stoma care, if needed

9. Suction, if needed

10. Have the second person hold the trach tube at the flange. Remove the old trach ties. Take care the trach tube does not fall out accidentally

11. If the patient has a cuffed tube, deflate the cuff completely

12. Take out the old trach tube but try not to pull it straight out. Use a motion that follows the curve of the trach tube

13. Guide the new trach tube into the stoma. Again, try using a motion that follows the curve of the trach tube

14. As soon as the new trach tube is in, remove the obturator

15. f the person is on a ventilator and has a cuffed tube, inflate the cuff

16. Place back on ventilator, or oxygen, if needed

17. Tie the trach ties and put on a clean dressing

18. Wash your hands

What should I do if I cannot get the trach tube in?

1. Moisten the trach tube with sterile distilled water and try again

2. Make sure you are using the obturator and that the cuff is completely deflated

3. Make sure the neck is extended. You may need to reposition the person or use a rolled towel under the shoulders

If the person can breathe and is not in distress:

- Ask the person to take a big breath in. Guide the tube in as they breathe in.
- Try to put in a smaller size trach tube.

5. Put the obturator into the stoma and gently pull down on the skin around the opening. This should open the stoma a little more giving you room to put in the smaller trach tube

6. If the smaller tube will not go in and the person is having trouble breathing:
   - Put the face mask on the manual resuscitator bag and place the mask over the nose and mouth to ventilate. You will need to cover the stoma
   - Have the second person call 911

The trach tube is out a little, but has not completely fallen out. What do I do?

1. Deflate the cuff on the trach tube (if it has one)

2. Gently push the tube back in

3. Adjust the ties so the trach tube will not fall out

What do I do if the trach tube is plugged?

1. If the patient is on a ventilator, the high pressure alarm will probably go off

2. Check to see if the patient is having trouble breathing

3. If so, try suctioning. If the suction catheter does not go down the trach very far then it may mean that the tube is plugged

4. If the patient is having trouble breathing you will need to act fast. Remove the inner cannula if it has one. If this doesn't help, remove the trach tube and insert a new one.

P. TRACH TUBE TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSE	WHAT TO DO
Air leaking from nose and mouth with a *cuff inflated* trach tube	Cuff is not filled enough to make a seal (with air or sterile water)	Take the air (or water) out of the cuff and re-inflate the cuff with the correct amount of air (or sterile water).
	There is a leak in the cuff, pilot line, or pilot line balloon	The trach tube needs to be replaced.
	The trach tube is too small for the trachea (windpipe)	Call your Doctor as you may need a larger sized trach tube
	Fenestrated inner cannula is in the trach tube	Take the air (or water) out of the cuff and re-inflate the cuff with the correct amount of air (or sterile water).
Trach tube is slightly out of opening in neck	Trach tube ties were too loose or not tied correctly	Gently re-secure the trach in the hole with the flange against the neck and re-tie the trach ties. Make sure you can only fit 1-2 fingers between the trach ties and the neck so the ties are not too loose.
Trach tube, or any part of the tube breaks or doesn't work	Lots of wear on the trach tube	Replace the trach tube
	Trach tube was cleaned using the wrong products	Replace the trach tube. Always use only those cleaning products that are recommended by the trach tube manufacturers. Read the trach tube cleaning instructions to be sure what you are to use.

PROBLEM	POSSIBLE CAUSE	WHAT TO DO
Unable, or difficult to put a suction catheter through trach tube and into airway. The trach tube seems blocked.	Mucus is plugging the trach tube	1. Try suctioning the mucus out. 2. Remove the inner cannula and replace it with a new or clean inner cannula 3. Try suctioning again. Is the catheter able to go in now? Is the person breathing ok or are they having trouble breathing? *If you are unable to pass the catheter still and the person is having trouble breathing, you will need to replace the trach tube as it is blocked.
	The suction catheter is too big for the trach tube	Contact your home Health Care Provider for guidance in the size of catheters needed.
	Trach tube is not properly positioned in the trachea, or windpipe	Gently reposition the trach tube so that it is not twisted and the flange is against the skin of the neck. Re-tie the trach tube properly.

Q. CONTACT INFORMATION

Make a Contact List with the following information and put it in a place where you and others can easily find it.

- All of your Doctors' names and their phone numbers
- Oxygen company, if you have one
- Ventilator Equipment Pool phone number, including on-call phone number
- Ventilator settings
- Trach tube information: size, type
- Emergency Phone numbers
- Your community healthcare support telephone number
- Community Care Access (CCAC) phone number
- Equipment supplier number, e.g. home care company

See **Section 9: Emergency Contacts and Planning** for more information.

R. HOW DO I ORDER PARTS?

The Assistive Devices Program (ADP) Ontario will cover you for 75% of all tracheostomy supplies if you are an Ontario Resident, have a valid health card, and have a disability that requires respiratory equipment or supplies for more than six months. You will be asked to cover the remaining 25%.

You will not be covered through ADP if you have Workplace Safety and Insurance Board or are a GROUP A Veteran or covered for the same respiratory equipment and supplies. Contact a local homecare vendor for these items.

Contact ADP website for further information: https://www.ontario.ca/page/respiratory-equipment-and-supplies

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3. INTRODUCTION TO HOME VENTILATION

In this Section, we will go over the basics of Home Ventilation. We will also define some terms used when talking about Mechanical Ventilation. Mechanical Ventilation will be discussed in more depth in **Section 4. Mechanical Ventilation.**

A. WHY IS VENTILATION NEEDED?

Certain conditions and diseases can affect the respiratory system. Mechanical ventilators can be needed for the following conditions:

- the brain does not send signals to the lungs to breathe
- the lung is too stiff to breathe well
- the lung tissue is damaged and causes breathing problems
- the breathing muscles are too weak to breathe well
- the heart is damaged and causes the lungs to work too hard

B. VENTILATION BASICS AND TERMINOLOGY

Mechanical Ventilation

- Mechanical Ventilation is the use of a breathing machine to help you breathe. Some people may need mechanical ventilation for some support and some need it for every single breath because they cannot breathe on their own.[1]
- The mechanical ventilator, or breathing machine, provides breaths of air for you to breathe in and it allows you to breathe out freely. The ventilator helps air move in and out of your lungs. This helps improve your body's oxygen levels and it also allows you to breathe out carbon dioxide. Carbon dioxide is a waste gas we all breathe out.
- Home Ventilation refers to the use of a ventilator at home, in the community or in a long term care facility.[1]
- Clients who are medically stable[2] but who rely on a breathing machine, may be eligible for ventilation at home with the proper support system.
- Mechanical Ventilation may be invasive or non-invasive (See **Section 3B: Invasive & Non-Invasive Ventilation**)
- Oxygen (O_2) may be prescribed by a Doctor to be given through the ventilator

Ventilator

- Breathing machine or Mechanical Ventilator
- There are different types of ventilators, but many of the modes and settings are similar.
- The ventilator displays parameters that are set as well as parameters that are measured.
- The measured settings change breath by breath whereas the set parameters do not change. The mode and set parameters are ordered by your Doctor.
- The ventilator is often powered by electricity and a battery.
- The battery may be internal or detachable (external)
- The ventilator can deliver oxygen as well if your Doctor prescribes it. Oxygen is usually added into the ventilator tubing

Fraction of Inspired Oxygen (FiO_2)

- When someone is prescribed oxygen through their ventilator, you will hear the amount of oxygen called FiO_2
- FiO_2 refers to the amount of oxygen in the air that we breathe in
- Also called 'oxygen concentration'
- The FiO_2 of what we all breathe is 0.21, or an oxygen concentration of 21%. The rest of what we breathe is air, nearly 79% air. If someone is prescribed oxygen, they will breathe in more oxygen than we do. This means their FiO_2 is higher than 0.21. There are various reasons why someone would be prescribed oxygen.
- In the home setting, oxygen is usually prescribed as a flow (lpm or L/Min).
- Oxygen may be ordered to be delivered to a patient through the ventilator at the prescribed flow rate (L/min). The flow is added into the home ventilator by attaching oxygen tubing to the oxygen inlet adapter of the ventilator (usually at the back of machine) Be sure you are shown how to attach the oxygen tubing and set the prescribed flow.
- Oxygen is considered a drug because it can have side effects if you use the wrong amount. For this reason, always use what is prescribed by your Doctor.

Alarms

In every mode of ventilation there are alarms set to keep the patient safe.
Alarms are there to alert the caregiver that something out of the ordinary is happening, perhaps an emergency situation. Alarm settings are determined by the Home Ventilation team and they are set to notify the caregiver as soon as something may be wrong or need attention. It is important to understand how to respond when an alarm rings. Always look at the client first before turning to the ventilator. This will discussed more in **Section 10: Caregiver's Assessment.**

C. INVASIVE AND NON-INVASIVE VENTILATION

Ventilation can either be Invasive or Non-Invasive. Whether or not ventilation is invasive or non-invasive depends on if the person breathes out of their nose and mouth or if the person has an artificial airway in. If the person has an artificial airway, like a tracheostomy tube or an endotracheal tube, the ventilation is "invasive". If the person does not have an artificial airway, the ventilation is "non-invasive".

Invasive Ventilation

Figure 1. www.ventusers.org/edu/valnews/images/MarkBoatman.jpg Alila Medical Shutter Stock 212074062.jpg

- Invasive ventilation is being ventilated through a man-made airway like a trach tube or an endotracheal tube
- Invasive ventilation may be needed only during sleep and naps or may be needed up to 24 hours a day depending on the person and their condition
- invasive ventilation modes may be Pressure or Volume ventilation
- Ventilator settings and measured values described with the following: PIP, PEEP, RR, VT, and O2 (lpm)

Non-Invasive Ventilation

Figure 2. www.ventusers.org/edu/valnews/images/MarkBoatman.jpg Alila Medical Shutter Stock 212074062.jpg

- Ventilation through a mask or a mouth-piece
- May be required only during sleep or up to 24 hours a day
- May be Pressure or Volume ventilation
- Ventilator settings and measured values described with the following: IPAP, EPAP, RR, VT and O2 (lpm)

D. LEVELS OF SUPPORT

Home Ventilation can be very different from one client to the next depending on how much help their lungs need. Some people need some ventilatory help (partial support) and some people need the ventilator to take over all of their breathing (total support). Some people need invasive ventilation and others may be able to avoid a tracheostomy and use non-invasive ventilation by a mask or mouth-piece. These options need to be discussed at length with your medical team. It is important to understand the benefits and risks of home ventilation no matter if it is invasive or non-invasive, partial or total support.

Total Support

When a person requires a breathing machine to do all of the breathing for them.[3] If the patient is at risk of dying without their breathing machine and must have alarms and a backup power supply for their ventilator then they are on total support. Patients that require total support are typically ventilated through a tracheostomy tube. However, total ventilatory support may also be offered non-invasively, especially if only required during sleep. Should a patient need total support while awake as well, mouthpiece ventilation may be used.

Partial Support

With partial ventilatory support, the person is able to breathe on their own between machine delivered breaths[3] and/or they may be able to increase their breath size during a machine delivered breath with some effort of their own. Partial ventilatory support can be given by mask or mouth-piece ventilation.

Independent Breathing Time

Independent Breathing Time (IBT) is the amount of time a person can spend off their ventilator. As a caregiver, it is very important to know how much time the client can breathe on their own, off the ventilator. For example, if the client cannot take one breath on their own, off of the ventilator, then their IBT is considered 0, or they have NO IBT. If the client is able to be off of the ventilator, and breathing on their own for 20 minutes, then they are said to have a 20min IBT. It is important to know what the client's IBT is in different situations. See below for factors that can change IBT.

- Body Position
  - IBT can depend on position the client is in (e.g. sitting in wheelchair, lying flat). A client may have an IBT of 30min sitting upright and an IBT of only 5 min lying flat in bed.
- Tracheostomy Tube:
  - IBT can be affected by whether the trach is open, has a filter in place, a cork on, or a Passy Muir valve on. It may vary on whether the cuff is inflated or deflated.
- Time of the Day:
  - For some people, they have a better IBT in the morning while others, do better in the afternoon. A client who is exhausted, partially asleep, hasn't done their LVR or is due to be suctioned, will not do as well on their IBT as they would otherwise.

Communication and IBT

Communication is important in preparing for and assessing IBT. Before removing client from ventilator, make sure you are aware what conditions the client will be able to breathe best in on their own (e.g. sitting upright, cork off, LVR first etc). Try to optimize the client first before removing the ventilator. Once the client is off, communication is important in determining when the client cannot breathe any longer on their own and need ventilatory support, by the ventilator or a manual resuscitation bag.

Communication is not just verbal as some clients cannot verbalize that they need help when they are too short of breath to speak. Communication is also non-verbal. Look for cues that the client is having a hard time breathing. See **Section 10: Caregiver's Assessment.**

IBT Can Change Over Time

Be sure to know your client's IBT and be aware that over time, IBT can change. IBT can improve in some situations, and in others, IBT can get shorter and shorter. This could be because of the disease progressing. Or, it could be because the client has an infection. Always be prepared to respond and support breathing if a client is not able to breathe on their own. The manual resuscitation bag should be within arm's reach at all times.

E. REFERENCES

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4. MECHANICAL VENTILATION

A. HOME VENTILATOR UNITS

To those who qualify, the Ventilator Equipment Pool (VEP) provides most ventilators in the community. Although the VEP has access to several different types of ventilators, the VEP mainly uses Philips Respironics Trilogy ventilator in the home setting. See how to qualify for VEP/ADP in **Section 12. Funding Coverage Overview.** Keep your Trilogy Ventilator User's Manual handy as a resource.

Figure 1.0

https://images.philips.com/is/image/PhilipsConsumer/HC1040005-IMS-en_US?wid=435&hei=245&$pnglarge$

The Trilogy ventilator can be used invasively, through a trach tube or non-invasively, with a mask or mouthpiece. This **Section** will discuss Invasive Mechanical Ventilation though some of it pertains to non-invasive ventilation too. For more information on Non-Invasive ventilation, see **Section 5: Non-Invasive Positive Pressure Ventilation.**

Trilogy Ventilator Parts

- In-use carrying bag
- SD card
- Disposable or reusable circuits
- Oxygen inlet adapter

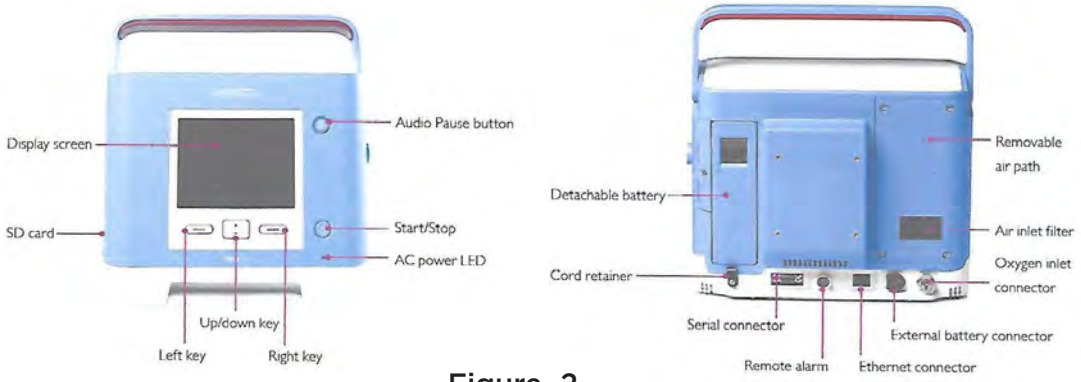


Figure 2.

http://www.philips.ca/b-dam/b2bhc/master/whitepapers/treating-restrictive-lung-disease-at-home/1061109_TrilogyWrk shpUS_Booklet.pdf

B. MODES OF VENTILATION

The Trilogy ventilator can provide both invasive and non-invasive ventilation. It also offers different modes of ventilation. The modes can be volume or pressure targeted.[2] In a Volume targeted mode, the ventilator delivers a set tidal volume (VT) for each breath given. In a Pressure targeted mode, the ventilator delivers a set pressure for each breath given.

Assist Control (AC) or Control (VC)

- The ventilator will assist your breath if you start to breathe in. If you are asleep or unable to take a breath, the machine will continue to deliver breaths.

Pressure Control (PC)

- This sets the highest pressure to be delivered during a breath. This set pressure is held for the whole 'breathing in' time

Pressure Support (PS)

- When Pressure Support is working, the machine will deliver a set pressure when the person takes a breath on their own. This makes the breath larger than what you may be able take without the ventilator.

Continuous Positive Airway Pressure (CPAP)

- CPAP mode provides a constant pressure of air when breathing in or out. This pressure helps keeps the lungs inflated.

C. VENTILATOR SETTINGS

The ventilator settings offered will depend on what type of ventilator you have and which mode you are on. Your personal settings are prescribed by your Doctor.

Common Ventilator Parameter:

Ventilator Rate

- Also called Breath Rate and Respiratory Rate (RR)
- In many modes, a set RR is delivered by the ventilator. This is the number of breaths the ventilator delivers in one minute. The client is able to breathe above the set ventilator rate if they want.
    - *Example:* The ventilator has a set RR of 12 breaths every minute (12BPM). This means, the ventilator will deliver 12 breaths every minute. The client can breathe faster, above that set rate, if they need to. They will get at least 12 BPM if they do not breathe above the set RR. For example, the set Respiratory Rate on the ventilator is 12 BPM. You count that the clients breathing at a RR of 16BPM. This means the patient is taking an additional 4 BPM on top of the set ventilator breaths. If the patient stops breathing on their own, the ventilator will give them 12 BPM.

Tidal Volume (VT)

- The amount of air the ventilator gives in a breath
- Measured in milliliters (ml)
- The best VT for each patient depends on their weight, age, and reason for needing mechanical ventilation
- The Home Ventilation team, or your Doctor, prescribes the VT setting

Inspiratory Time (I_T or T_I)

- The time it takes for the ventilator to give one breath
- Measured in seconds (s)

Inspiratory Flow Rate

- How fast the air travels during one breath
- Measured in liters per minute (lpm)

I: E Ratio (Inspiratory to Expiratory Ratio)

- The length of time it takes to breathe in compared to the time it takes to breathe out. This is a ratio.

Peak Inspiratory Pressure (PIP)

- This shows the amount of pressure it takes to fill up the lungs when you breathe in
- The number shown may be slightly different with each breath when the VT is set
- The amount of pressure is displayed on the control panel of the ventilator, either as a number on a screen or on a gauge

PEEP (Positive End Expiratory Pressure)

- This is the pressure the ventilator holds at the end of each breath.
- PEEP helps to keep the lungs inflated even when you breathe out. It prevents the air sacs in the lung from collapsing.

Sensitivity or Breathing Effort

- This control shows how much effort is needed to start a new breath from the ventilator

Minute Ventilation (MV or VE)

- Minute volume is the amount of air, in liters, that a person breathes in one minute
- Minute volume can be measured by the ventilator. You can also calculate it by multiplying the tidal volume (VT) by the respiratory rate (RR)
- VE is measured in L/min or lpm
- This value is important to measure when we are concerned about carbon dioxide levels (CO2). The VE can give us an idea how much carbon dioxide, or waste gas, we breathe out. If we need to breathe out more carbon dioxide, we can increase the VE on the ventilator. If we need to breathe out less carbon dioxide, we can decrease the VE on the ventilator.

Oxygen

- If your doctor wants to give more oxygen, low pressure oxygen may be added into oxygen inlet connector at the back of the ventilator

D. VENTILATOR ALARMS

Ventilator alarms will tell you if there is a problem with the patient or the machine. When an alarm is triggered, the ventilator will make alarm sounds and warning lights will show on the ventilator screen. It is important that alarms are set within safe ranges. For more information on alarm conditions and responses, see **Section 4J: Mechanical Ventilation: Troubleshooting.**

IMPORTANT! Alarms will warn you that there is a safety concern. When an alarm goes off, you need to pay attention to it right away!

IMPORTANT! Never change the alarm settings!

Some common and important alarms are:

Low Pressure

- This alarm is triggered when there is a leak somewhere in the circuit
- The leak could be in the tubing, connections, mask or trach tube.
- A Low Pressure alarm means that there is not enough air being delivered to the patient.
- The circuit may have "popped" off the trach tube. It is important to start at the patient and work your way to the ventilator by checking that all the connections are tight and air isn't leaking. If the patient is unable to breathe on their own, make sure that the resuscitation bag is nearby and you can use this to breathe for the patient while you find the cause of the leak. [2 (42)]

High Pressure

- This alarm is triggered if there is something in the way of the air going to the patient.
- There is something "blocking" the flow of air.
- This can happen if there is mucus in the airway or trach, or water in the tubing.
- The patient may need suctioning or the tube drained of water.
- It also happens if the patient is coughing, hiccupping or the tubing has been kinked somewhere along the line.

Vent IN-OP

- The Vent IN-OP will alarm if there is a condition that might affect the ventilator working properly.
- The ventilator will shut down if it cannot deliver the air safely.
- It occurs when the ventilator detects an internal error or a condition that may affect therapy.

Circuit Disconnect

- This is a high priority alarm. It occurs when the breathing circuit is disconnected or has a large leak. The device continues to operate. The alarm will automatically stop when the circuit is reconnected or the leak is fixed.

You are encouraged to know which alarms are set for you and what each alarm means.

Fill in your personal Ventilator mode and settings below.

My Ventilator Make and Model is:

_____

Mode:

_____

Set Parameters:	Set Alarms:
_____	_____
_____	_____
_____	_____
_____	_____

E. VENTILATOR POWER SOURCES

Ventilators operate on electricity. The device can operate on A/C or D/C power. The Trilogy ventilator draws power from sources in the following order:[1(45), 2]

1. A/C Power
2. External Battery
3. Detachable Battery Pack
4. Internal Battery

Alternating Current (A/C)

Most of the time your ventilator will be plugged into your home wall outlet which is 120 volts of alternating current (A/C). Always use wall outlet power if you are planning to stay in one place. An A/C power cord comes with the ventilator.

Plugging in the Ventilator to A/C power

1. Plug the socket end of the A/C power cord into the A/C power inlet on the side of the ventilator. To prevent accidental removal of the A/C power cord from the ventilator, you may secure the A/C power cord to the ventilator using the A/C power cord retainer located on the back of the device.
2. Plug the pronged end of the cord into a wall outlet not connected to a wall switch. Ensure that all connections are secure. If A/C power is connected correctly and the device is operating properly, the green A/C LED light should be lit.[1 (45), 2 (51-52)]

Figure 3. https://images.philips.com/is/image/PhilipsConsumer/HC1040005-IMS-en_US

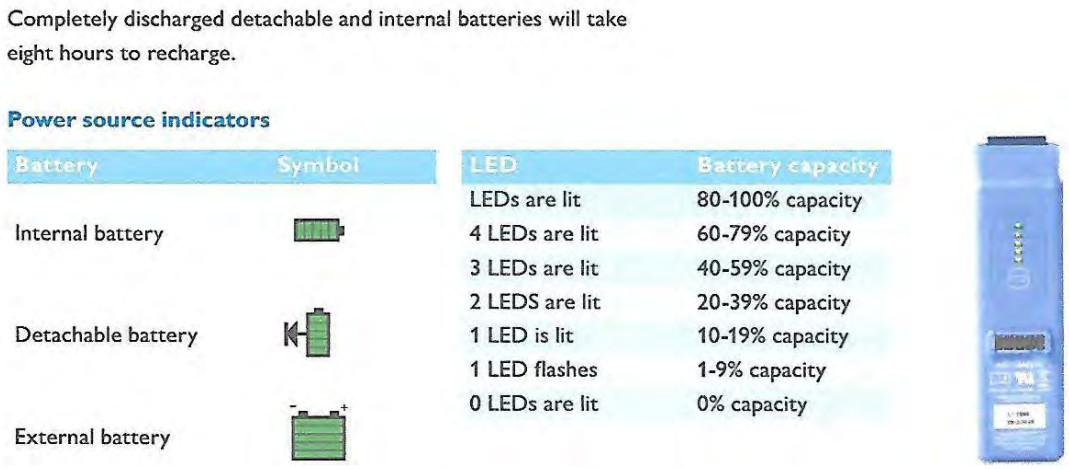
Internal Battery

- The Trilogy ventilator device contains an internal battery that can be used as a backup power source only
- It is intended for use during short periods while switching between external power sources, emergency situations, or short durations when the user needs to be mobile.
- The length of time the ventilator will operate on internal power depends on the settings, battery charge level, and condition or age of the battery.
- When fully charged, a new battery can power the ventilator for about three hours
- Whenever the ventilator is connected to A/C power, it will automatically recharge the internal battery.
- A completely discharged internal battery will reach 80% charge status within 8 hours when charging
- If there is no A/C or detachable battery power available, the internal battery symbol will have a black box around it to indicate that it is in use.

Detachable Battery Pack

- The VEP offers the Philips Respironics detachable Lithium-Ion battery pack
- To use the detachable battery pack, snap the battery into place on the back of the ventilator.
- When the device is not connected to an A/C power source or an external battery, the detachable battery will power the device, if attached.
- The length of time the ventilator will operate on battery power depends on the settings, battery charge level, and condition or age of the battery. When fully charged, a new battery can power the ventilator for about three hours.
- If you are only using the detachable battery, the detachable battery symbol on the front screen has a black box around it to indicate it is being used.
- When the ventilator is connected to A/C power, it will automatically recharge the detachable battery pack.
- A completely discharged detachable battery will reach 80% charge status within 8 hours.
- Insert and securely latch the detachable battery into the ventilator. One side of the detachable battery has a set of LEDs that indicate the amount of charge left on the battery. You can press the button to view how much of the charge remains.

Figure 4. Detachable Battery in Trilogy 200.
http://www.philips.ca/healthcare/product/HC1040005/trilogy200-ventilator



Completely discharged detachable and internal batteries will take eight hours to recharge.

Power source indicators

Battery	Symbol
Internal battery	
Detachable battery	
External battery	

LED	Battery capacity
LEDs are lit	80-100% capacity
4 LEDs are lit	60-79% capacity
3 LEDs are lit	40-59% capacity
2 LEDS are lit	20-39% capacity
1 LED is lit	10-19% capacity
1 LED flashes	1-9% capacity
0 LEDs are lit	0% capacity

Figure 5. Power indicator on Trilogy detachable battery.
http://www.philips.ca/b-dam/b2bhc/master/whitepapers/treating-restrictive-lung-disease-at-home/1061109_TrilogyWrk shpUS_Booklet.pdf

External Battery

- The ventilator can operate from a 12V D/C deep cycle marine-type (lead acid) battery using the External Battery Cable provided by the VEP
- The Ventilator Equipment Pool (VEP) provides an external D/C battery for emergencies such as a power outage. The VEP also provides a battery charger.

The battery is a standard 12 volt battery that would provide power to the ventilator for 5-12 hrs. It is not charged through the ventilator.[2(53-56)]

IMPORTANT! This battery should not be used for portability, such as with a wheelchair. It is for emergency backup power only.

How do I hook up the external battery to the ventilator?

1. Check to make sure the battery is fully charged. If it needs charging, charge it first. Never charge the battery while the battery is connected to the ventilator
2. Place the battery in a safe place away from the ventilator's inlet filter (on the back of the ventilator panel). Do not put the battery on top of ventilator
3. Plug the VEP provided battery cable into the proper connection on the ventilator
4. Plug the battery cable into the battery
5. Turn on the ventilator and ensure it is operating correctly.

Figure 6. Trilogy Ventilator with 12V marine battery, battery cable- courtesy of the Ventilator Equipment Pool. March 2017

IMPORTANT! Some internal ventilator batteries may not recharge when the ventilator is plugged into an external D/C battery.

How do I remove the external battery from the ventilator?

1. Unhook the battery cable from the battery
2. Unhook the battery cable from the ventilator
3. Make sure ventilator is plugged into the wall outlet (A/C power source)
4. Recharge the battery in a well ventilated area using the battery charger provided by the VEP [1(46)]

I would like to use my ventilator with my wheelchair. What battery should I use?

A battery is needed when you use your ventilator with your wheelchair. You will need to buy another battery for this purpose. Discuss this with your wheelchair vendor, Occupational Therapist, and Respiratory Therapist.

IMPORTANT! Do not use the external battery that VEP has given you. That one is for emergency use only. VEP does not supply batteries for wheelchair use.

When do I need to recharge the external battery?

- Recharge the battery after every use in a well ventilated area
- Old batteries will lose their charge quickly so check the battery charge every week
- Discharge and recharge the battery monthly

How do I recharge the external battery?

1. Charge the battery in a well ventilated area
2. Do not charge the battery when it is hooked up to the ventilator
3. Use a 12 volt battery charger to recharge the battery
4. Connect the battery to the charger
5. Connect the charger to the wall outlet (A/C power)
6. Let the battery charge. Note: It will take one hour of recharge time for every hour that it was used
7. When the battery is 80% charged, the yellow light will flash
8. When the battery is 90% charged the green light will come on. When the green light is on it means the charge is complete
9. Leave the battery hooked up to the charger for another 3 hours after the green light comes on
10. When the battery is fully charged, unplug the charger from the wall outlet first, before unhooking the charger from the battery

F. THE VENTILATOR CIRCUIT

There are many types of ventilator circuits that can be used with the ventilators. Some circuits are used with a tracheostomy tube, and some with a face or nasal mask. Some ventilator circuits will have a water collection trap to collect water and condensation in the tubing if attached to a humidifier and others may have an exhalation port to help you exhale out to the room. Some circuits will be reusable and others will be disposable.

The setup that you have at home will depend on many factors. The picture below shows just some of the parts that you may have in your circuit. Please ask your Respiratory Therapist about the parts that are in your circuit.

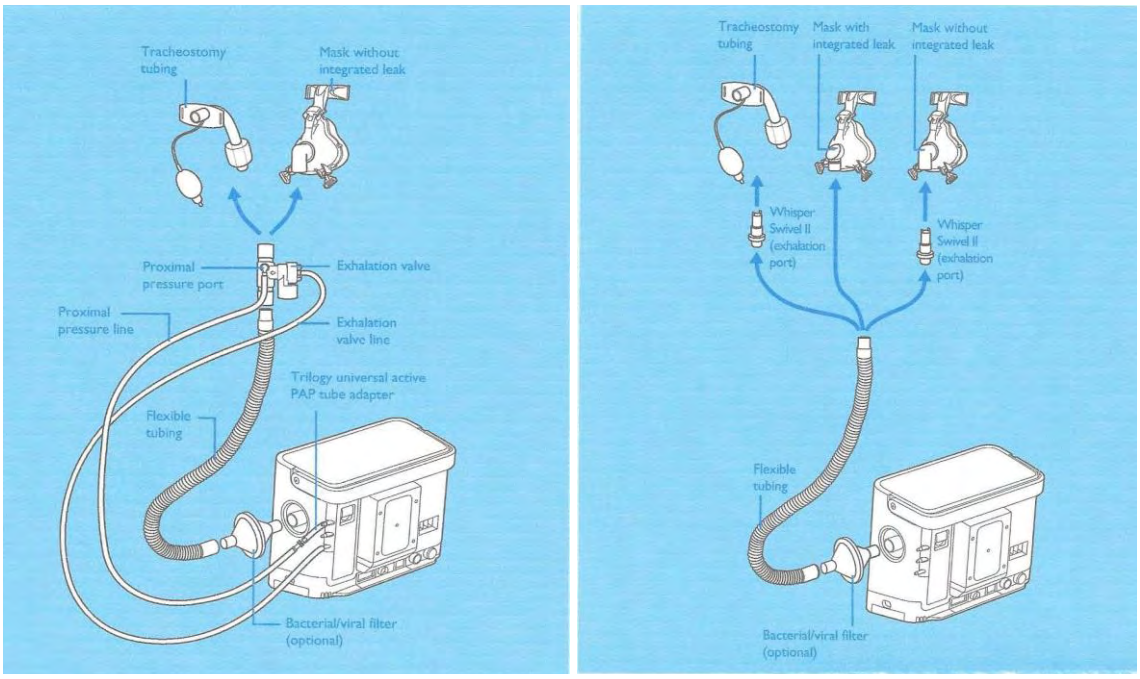


Figure 7. Quick Start Guide Philips Respironics. http://incenter.medical.philips.com/doclib/enc/9968902/T200QuickStartGuide.pdf%3ffunc%3ddoc.Fetch%26nodeid%3d9968902

G. TESTING THE VENTILATOR CIRCUIT

It is important to check that the circuit is working properly before using it on someone. Make sure all the parts are tightly connected together before testing the circuit. Follow the directions in your ventilator's User Manual to learn how to test the ventilator circuit.

Active Circuit Leak Test for the Trilogy 200

Follow these steps when you change the circuit or when you suspect a leak in your circuit. This ensures that the circuit itself is complete and the exhalation valve is not leaking.

Follow the steps with the ventilator off and the Active PAP circuit attached.

1. Push down arrow and Silence/Mute button at the same time
2. You will now be in SETUP menu
3. Using the down arrow, push down until you see "Active Circuit Leak Test"
4. Hit Select button
5. Block end of Circuit with your thumb as directed
6. Press "OK"
7. "Circuit Leak Test" in progress appears on screen
8. If passed and no leaks detected, "Circuit Leak Test Passed" will appear on the screen and prompt you to unblock the end of the circuit
9. Hit OK
10. Hit EXIT – machine will now be off
11. Turn on ventilator as usual and begin using as normal.

H. VENTILATOR & VENTILATOR CIRCUIT CLEANING

Keeping your equipment and parts clean may be the most important thing you can do to avoid infections and stay healthy. Circuits infected with bacteria may infect your lungs. Clean the respiratory circuit on a regular basis. If you are using a disposable circuit, dispose of and replace it on a regular basis.

DAILY

1. Exterior Surface of Ventilator:
   - Before cleaning exterior of Ventilator, unplug the unit
   - Clean the front panel and the exterior of the machine with a clean cloth dampened with water or a mild detergent wipe with a clean dry cloth

WARNING! To avoid electrical shock, always unplug the power cord from the wall outlet before cleaning the ventilator.

CAUTION! Do not immerse the device or allow any liquid to enter the enclosure or the inlet filter.

CAUTION! Do not use harsh detergents, abrasive cleaners, or brushes to clean the ventilator system.

2. Humidifier
   - Empty the water daily and replace with clean distilled water.

WEEKLY

1. Wipe down the ventilator with a damp cloth
2. Clean, wash or change the Ventilator Circuit
   - Remove circuit and connectors
   - Wash tubing with mild detergent, rinse well with tap water
     If the client is feeling unwell or there are signs of infection, you should soak tubing in 1:3 ratio of vinegar to distilled water for 1 hour. Rinse completely with tap water. Air dry completely before using.

3. Grey Foam Filter
   - Clean weekly and replace every six months. Wash filter with warm water and mild detergent, rinse well and air dry before placing back into the ventilator

CAUTION! The reusable foam inlet filter is required to protect the ventilator from dirt and dust. Wash periodically and replace when damaged for proper operation.

NOTE: Never install a wet filter into the device. It is recommended that you clean the filter in the morning and alternate using the two foam filters provided with the system to make sure there is enough drying time for the cleaned filter

4. Clean and wash the humidifier container and tubing weekly in warm soapy water and rinse well, air dry before use.
5. Clean and wash the portable suction canister
6. Check that the external battery is charged

MONTHLY

1. Change the bacteria filter in the breathing circuit
2. Change or clean the inlet filters on the ventilator. These must be replaced/cleaned as necessary
3. Discharge and recharge the external battery

ANNUALLY, or as needed

Preventive maintenance is recommended by the manufacturer. Some ventilators need to be serviced every 1-2 years, or after a certain number of hours of use
The Ventilator Equipment Pool staff will call you when your ventilator needs maintenance.

I. VENTILATOR SAFETY

- It is always important to never move the ventilator if it is attached to a humidifier with water in it. The water can enter the ventilator and cause damage to the unit.
- Place the ventilator on a night stand or table away from drapes or other things that could block the airflow to the inlet filter opening
- Spills will damage the ventilator and cause it to not work properly. Never place food or liquids on top of the ventilator
- Make sure the humidifier is lower than your head
- Make sure the alarm port is not blocked by objects. If it is blocked, it may not be heard if it goes off

J. TROUBLESHOOTING

Be sure to review the 'Troubleshooting' section in your ventilator's User's Manual then review it with your Respiratory Therapist. We have included some of the more common alarm conditions and causes in the table below, though this is not a complete list.

PROBLEM OR ALARM	POSSIBLE CAUSE	WHAT SHOULD I DO
Low Pressure Alarm (There is not enough air being delivered to the patient)	There is a leak somewhere in the circuit.	Start at the patient and look along circuit to ventilator. The circuit could have 'popped' off the trach tube. Check that all connections are tight and no air is leaking. If the patient is unable to breathe on their own, help them breathe with the resuscitation bag while you look for the leak.[2 (42)]
	If you have a cuffed trach tube, there may be a leak in the cuff, inflation line, pilot balloon or luer valve.	Disconnect the ventilator tubing from the trach tube. Deflate and reinflate the cuff with the proper volume. Replace the tube if it does not remain inflated. Reconnect the ventilator to the trach and ensure ventilation..
High Pressure Alarm (There is something 'blocking' the flow of air to the patient)	Ventilator tubing is blocked or kinked	Unkink or unblock ventilator tubing
	Mucus is plugging the trach tube or airway	Suction to clear mucus
	Water, or rain out, in the circuit has collected and is blocking air flow to the patient	Drain the ventilator circuit of water or condensation
	The patient is coughing or hiccupping	If the patient is coughing, they may need suctioning

PROBLEM OR ALARM	POSSIBLE CAUSE	WHAT SHOULD I DO
Vent IN-OP Alarm (Something is causing the ventilator to not work properly)	Internal Error detected or a condition that may affect ventilation	Disconnect patient from ventilator and deliver breaths with a resuscitation bag. Call the VEP
Circuit Disconnect Alarm	Breathing circuit is disconnected or there is a large leak	Reconnect the breathing circuit or fix the leak

K. WHEN TO GET SUPPORT & CONTACT INFORMATION

If you are having technical issues with the ventilator, review the User Manual's Troubleshooting section. If you are still having technical issues with the ventilator, call the VEP or your Respiratory Care Company for support. If you have been prescribed a back up ventilator, switch over to the second unit. If your client is having trouble breathing in the meantime, use the resuscitation bag to help him/her breathe.

VEP 1-800-633-8977 or 1-613-548-6156

My Respiratory Care Company is: _____

Telephone number: _____

L. HOW DO I ORDER PARTS?

The ventilator and the parts (humidifier, battery, charger, and circuits) required to operate the ventilator are supplied at 100% coverage through the Assistive Devices Program through the VEP. They are on a long term loan to you for as long as required. The VEP will send you 2 ventilator circuits every 2 years. The ADP will provide you with an annual grant of money which you can use towards buying masks, connectors, filters and any other items you may need. You may go to any medical vendor for these supplies.[3]

M. REFERENCES

1. Bayliss M, Hamp C,Johnson D, et al. Ontario, Canada. June 2010. Optimizing Respiratory Therapy Services. A Continuum of Care from Hospital to Home. Patient/Clients and Caregivers

2. Trilogy 200 Clinical Manual. Ontario Ventilation Equipment Pool Website. http://ontvep.ca/w/wp-content/uploads/2014/05/Trilogy200-Clinical-Manual.pdf
© 2010 Koninklijke Philips Electronics N.V. Accessed March 27, 2017

3. Frequently Asked Questions. Ontario Ventilator Equipment Pool website. http://ontvep.ca Published 2014. Accessed March 27, 2017

5. NON-INVASIVE POSITIVE PRESSURE VENTILATION

INTRODUCING THE OTTAWA HOSPITAL CANVENT PROGRAM

The Champlain LHIN is very fortunate to have the CANVent program (Canadian Alternatives in Non-Invasive Ventilation). This unique program is headed by respirologist Dr. Doug McKim MD, based out of the Ottawa Rehabilitation Centre of The Ottawa Hospital. Dr. McKim and his team play a central role within our community by identifying individuals who are at risk for and preventing serious or life threatening complications such as respiratory failure. Through their work and education of non invasive airway management (NIVAM) strategies, Dr. McKim and the respiratory therapists in the CANVent Program have significantly reduced or eliminated the risk of respiratory complications, in patients with neuromuscular diseases such as ALS, muscular dystrophy(MD), spinal cord injury, MS, post-polio syndrome and others.[1] NIVAM strategies include lung volume recruitment (LVR), mechanical cough assistance (Cough assist), elective non-invasive ventilation all of which are done on an outpatient basis with no admission to the hospital. These techniques and strategies are taught early in the disease process to help decrease the chance of urgent invasive trach ventilation and hospitalization and allow those individuals to become familiar with the lung clearance techniques and non-invasive ventilation.

In many other health regions across the country, NIVAM strategies are not widely used and patients may go unrecognized in their risk for respiratory failure. For example; almost every wheelchair assisted person with neuromuscular weakness will develop a decreased ability to clear secretions, increasing the risk of pneumonia and respiratory failure as a result of a common upper tract infection. They are then more likely to present to the emergency department and require a breathing tube, admission to ICU, tracheostomy, prolonged invasive mechanical ventilation and hospital stays in the intensive care unit or permanent institutional care.[2,3,4]

The CANVent team provides professional and patient education to decrease the respiratory complications of these individuals and promote survival and quality of life, allowing these individuals to remain in their home.

This next section on Non-Invasive ventilation further explains the principles developed by the CANVent Program.

1. www.canventottawa.on.ca C 2016 all rights reserved Affiliated with the Ottawa Hospital and University of Ottawa

2. McKim DA, Griller N, LeBlanc C, Woolnough A, King J. 24 hour non-invasive ventilation in Duchenne muscular dystrophy: a safe alternative to tracheostomy. Can Respir J 2013:20(1); e5-e9.

3. Brook D, De RosieJ, Mousseau M, Avendano M, Goldstein RS. Long term follow-up of ventilated patients with thoracic restrictive or neuromuscular disease. Can Respir J 2002 Mar-Apr; 9(2):99-106.

4. Bedard M-E, McKim DA, Daytime mouthpiece for continuous non-invasive ventilation in individuals with amyotrophic lateral sclerosis. Respiratory Care, June 2016.

Ventilation can either be Invasive or Non-Invasive. Whether or not ventilation is invasive or non-invasive depends on if you breathe in and out of your nose and mouth or if you have an artificial airway. If you have an artificial airway, like a tracheostomy tube, the ventilation is "invasive". If you do not have an artificial airway, the ventilation is"non-invasive". This section will discuss non-invasive ventilation, specifically Bilevel ventilation. See **Section 6: Mouth-Piece Ventilation** for non-invasive ventilation using a Mouth-Piece.

A. WHAT IS BILEVEL?

Bilevel positive pressure ventilation is a non-invasive way of providing breathing support to you with a small, quiet machine and an interface. The interface is the part you put on your face. It can be a mask that goes over your nose, or a mask that covers both the nose and mouth. Bilevel ventilation is not intended for life support.

The prefix 'bi' means two and refers to two pressures. Bilevel provides two pressures: one for breathing in and one for breathing out. The pressure it delivers when breathing in is the inspiratory positive airway pressure (IPAP). It will make the breath larger. The second pressure is given when you breathe out. This pressure is called the expiratory positive airway pressure (EPAP). This is the pressure the ventilator holds at the end each breath. It helps to keep the lungs inflated when breathing out and prevents the air sacs in the lung from collapsing. There is a back-up respiratory rate (RR) that will support your breathing if your breath rate falls below a certain number of breaths per minute.[1] With a back-up respiratory rate, if the client does not breathe often enough, the ventilator will make sure that they get a minimum number of breaths each minute.

B. WHY IS BILEVEL NEEDED?

There are many reasons why your Doctor may have prescribed a Bilevel ventilator for you. Some of these reasons may be:

- You have a neuromuscular disease and need breathing support at night
- You have breathing sleep disorder that is uncontrolled with Continuous Positive Airway Pressure (CPAP)
- You have Chronic Obstructive Pulmonary Disease (COPD)

C. GETTING STARTED

When we sleep we do not breathe as deeply or as fast as when we are awake. If you do not have normal lungs or have respiratory muscle weakness, you may not be able to take in as much oxygen or get rid of the carbon dioxide as well as. The Bilevel ventilator will help you to keep oxygen and carbon dioxide levels closer to normal. The result is less sleepiness and more energy during the day[1, 2]

Masks are a personal choice. There are many manufactures of masks on the market for you to choose from. It is best if you get a mask fitting to determine the style and type of mask that will work best for you. Finding the best mask fit is important so that you wear it as prescribed.

D. LIVING WITH BILEVEL

When you first try the Bilevel unit, try to be as relaxed as possible and breathe normally. You are controlling the machine; it is sensing when you breathe in and out. When breathing in it will trigger the machine to deliver an inspiratory pressure. The Bilevel machine will drop the pressure when it senses you are breathing out. The machine will respond to your breathing efforts to make your breathing as comfortable as possible. As you become more comfortable with it, increase the amount of time wearing it. It could be during an afternoon nap or even watching TV. The goal is to wear it overnight, as you sleep. Continue to go about your regular routines, or activities of daily living, during the day.

E. BILEVEL UNITS

If you have been prescribed a Bilevel unit from the VEP, there are 2 main devices that are used in the home. These are provided on a long term loan to you. Your unit may be different from the units shown below.

ResMed Stellar 150 - with and without the humidifier attached

Figure 1. ResMedStellar.com

Philips Respironics BiPAP A40 with attached humidifier module

Figure 2. http://www.eastin.eu/en/searches/products/detail/database-rehadat/id-IW_040312.250

F. BILEVEL PARTS

Each unit will come with a blower unit, power cord, humidifier, a 36 inch single limb tube, filters and carrying bag.

It will be up to you to determine the best mask to wear and this can be the most difficult part of the setup. There are several different types of masks on the market and each has their own pros and cons. Find a vendor who will allow you to have a mask fitting and trial. That will allow you to try several types out before deciding on a mask. If the mask is not comfortable or creates leaks you will have more difficulty in adjusting to this new therapy.

IMPORTANT! No matter what type of mask you choose, be sure to know how to identify the exhalation port. This is where you breathe out and it must never be blocked.

G. BILEVEL MODES

How the air is delivered to you is called the Mode. There are several common settings used when setting up a Bilevel unit. Typically, the units are setup in either:

1. Spontaneous Timed Mode (S/T)
   In this mode, when you take a breath, the machine will deliver the set IPAP pressure. If you do not trigger a breath within a certain time frame, the machine will deliver a breath.

2. Pressure Control Mode (PC)
   In this mode, the machine will give you a breath and cycle to exhalation after certain settings and pressures have been reached.

H. BILEVEL SETTINGS

Settings can vary greatly from person to person and amongst Bilevel units. Your settings will be determined by your Respiratory Therapist and Doctor based on the prescription and comfort.

Fill in your Bilevel information below..

Make and Model is:

_____

My Bilevel settings are:

Mode	_____	Other Settings	_____
IPAP	_____		_____
EPAP	_____		_____
RR:	_____		_____
Ti min-max	_____		_____
Rise	_____		_____

If you need to add supplemental oxygen to your Bilevel device, follow the directions in your unit's User's Manual. The Stellar 150 will add O2 at the back of the unit whereas the BiPAP A40 requires a specific Respironics pressure valve to be placed between the unit and the circuit.

I. BILEVEL ALARMS

The more support required from the Bilevel unit, the more alarms will be set. The most common alarms are:

- **Circuit Disconnect Alarm**
  This is a high priority alarm. It occurs when the breathing circuit is disconnected or has a large leak (e.g. leak at the mask). The Bilevel will continue to work. The alarm will automatically stop when the circuit is reconnected or the leak is fixed[3]

- **High Pressure Alarm**
  This is activated if there is a blockage in the air flow from the machine to your mask. It is usually set at 30cmH2O. [4,5]

- **Low Pressure Alarm**
  If there is a large leak, the machine will alarm to let you know so you can fix the leak. It is usually set at -3 cmH2O. [4,5]

J. BILEVEL POWER SOURCES

The Bilevel units can operate for short periods of time without an A/C power source. It is important to have a backup plan in the event of power outages greater than 3 hours.

The BiPAP A40 machine can work on 3 different power sources.
The BiPAP A40 unit will access power in the following order, if connected:

1. A/C power (the wall outlet)
2. External battery (12Volt marine battery if connected)
3. Detachable battery pack

The detachable battery pack allows anywhere from 5 to 10 hours of back-up power depending on the settings on your unit. You may be able to obtain this module for your A40 from the VEP.[4]

Figure 3. BiPAP A40 with battery pack module attached.http://www.philips.com.tr/healthcare/product/HC1078226/bipap-a40-Bilevel-ventilator

The Stellar 150 machine has an internal battery that, depending on the settings and conditions, will operate for 2 hours only. It is recharged by connecting the unit to the A/C power by the wall outlet. It can take up to 3 hours to recharge, depending on the conditions and if the unit is in use during this time. The internal battery has to be discharged and recharged every six months. Please review the Stellar 150 User's Manual.[5]

K. CLEANING

It is very important to keep all pieces of your Bilevel unit clean. You can help prevent lung infections by keeping your Bilevel unit, circuit, and mask clean. The tubing delivering the air to your mask and lungs may collect dust and even mold. The humidifier chamber should also be washed weekly[1(9)]

Keeping the mask clean will also prevent skin sores or skin breakdown. When you keep the mask clean, you reduce facial oils from causing the mask plastic to break down.

When the mask plastic breaks down, you tend to tighten the mask to the face too much to prevent leaks, which cause skin sores.

Daily Cleaning

- Wipe your mask with a damp cloth every morning to remove any facial oils from the night before. This will help prolong the life of the mask
- Empty your humidifier water every morning and refill with distilled water

Weekly Cleaning

- Using mild dish soap (free of any lotion or antibacterial components); fill a clean sink with warm water and the dish soap.
- Wash the mask, headgear, humidifier and tubing separately
- Rinse in warm water.
- Shake of the excess water
- Let air dry by hanging on a towel rack, for the rest of the day or until dry [3,4]
- If you are fighting an infection you can add 1 part vinegar to 3 parts water and let the items soak for 30 minutes, then rinse and air dry.

L. TROUBLESHOOTING

Most of the issues in this Section relate to mask and humidity issues. Please review your Bilevel's User Manual for a complete guide to troubleshooting.

PROBLEM	WHAT COULD BE THE CAUSE	WHAT TO DO
The face is red and irritated where the mask sits	Mask is too tight	• Loosen straps • Use a barrier between the mask and skin
	Skin allergy to mask OR Skin allergy to the soap used to clean the mask	• Try another mild dish soap (without lotions or antibacterial additives)
Red or sore eyes	Air is leaking into the eyes	Try reseating the mask and readjusting. If it continues, call your mask vendor as you may need a new mask[1 (12)]

PROBLEM	WHAT COULD BE THE CAUSE	WHAT TO DO
Nose is stuffy or runny	Humidifier is not being used correctly	• Increase the temperature on the humidifier • Make sure the filters on the machine are not blocked • Make sure there is enough distilled water in the canister
Mouth is dry	Humidifier is not being used correctly	• Consider adding a chin strap • Consider using a full face mask that covers your mouth

IMPORTANT! Remember to always check for constant airflow from the exhalation port. Do not mistake this airflow for a mask leak!

M. WHEN TO GET SUPPORT & CONTACT INFORMATION

If your Bilevel unit was provided by the VEP and you are having problems with the unit, you may call the VEP with your questions and concerns. For clinical concerns about how you are tolerating the Bilevel therapy, call your Respirology clinic and speak with your Respiratory Therapist.

VEP 1-800-633-8977 or 1-613-548-6156

My Respiratory Care Company is: _____

Telephone number: _____

My Respirology Clinic's Telephone Number: _____

N. HOW DO I ORDER PARTS?

The ventilator and the parts (humidifier, battery, charger, and circuits) required to operate the unit are supplied at 100% coverage through the Assistive Devices Program (ADP) from the VEP. They are on a long term loan to you for as long as required. The VEP will send you 2 ventilator circuits every 2 years. The ADP will provide you with an annual grant of money which you can use towards buying masks, connectors, filters and any other items you may need. You may go to any medical vendor for these supplies.

O. REFERENCES

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5. Stellar 150 Clinical Guide. Ontario Ventilator Equipment Pool Website. http://ontvep.ca/w/wp-content/uploads/2014/05/Stellar-150-Clinical-Guide.pdf Published 2014. Accessed March 27, 2017

6. MOUTH-PIECE VENTILATION

A. WHAT IS MOUTH-PIECE VENTILATION?

Mouth-Piece Ventilation (MPV) is a mode of non-invasive ventilation. By 'sipping' from a mouthpiece, a satisfying breath is delivered from the ventilator on demand. Mouth-Piece Ventilation is helpful if you have a neuromuscular disease or spinal cord injury and need more breathing support during the day because of weak breathing muscles. Taking a breath from the mouth-piece ventilator takes practice at first. You will learn how to put your lips firmly around the mouthpiece and, using your cheek muscles, sip air through the mouthpiece, like sipping water through a straw. The ventilator will know that you are there, by sensing your 'sipping,' and deliver a breath. You may feel a gentle stretch in your chest before you exhale out to the room. Mouth-Piece Ventilation can be set up on your wheelchair. [1,2]

Figure 1. Trilogy Ventilator set up with MPV http://www.usa.philips.com/healthcare/product/HC1054260/trilogy100-ventilator

B. WHY IS MOUTHPIECE VENTILATION NEEDED?

Mouth-Piece Ventilation helps those who need more breathing support during the day. The advantage of MPV is that it is less intrusive than wearing a face mask for Bilevel and less invasive than a tracheostomy with invasive ventilation. Because MPV is less intrusive and invasive, it may help improve your quality of life as you can be more mobile in your daily life. It can be used for daily chest stretches, or lung volume recruitment (LVR), and assist with making your cough stronger.[2,3,4]

C. GETTING STARTED

To be a candidate for MPV, you must have strong cheek and mouth muscles to take in the breath to your lungs. You also must be alert, and able to speak and communicate.[3] You must be alert enough to take a breath when you need it. You should be able to communicate if you are not getting enough support from the ventilator or unable to clear secretions well enough.

If you are using your Bilevel more and more during the daytime, you may be a candidate for Mouth-Piece Ventilation. Speak to your Doctor or Respiratory Therapist if you are using your Bilevel more during the daytime as it may be time to consider MPV.

D. LIVING WITH MOUTHPIECE VENTILATION

It is helpful to mount the ventilator to your wheelchair if you will be using MPV during the day. The ventilator and its battery will require regular charging so it is always ready for you to use. Mounting the ventilator on the wheelchair requires assistance from your Occupational Therapist, Respiratory Therapist, and wheelchair vendor.

Figure 2. Trilogy Ventilator mounted on back of wheelchair http://incenter.medical.philips.com/doclib/enc/10256462/TrilogyDataSheet.pdf%3ffunc%3ddoc.Fetch%26nodeid%3d10256462

E. MOUTHPIECE VENTILATOR

Within the community, the Philips Respironics Trilogy 200 is often the ventilator used for MPV. If you qualify, the Trilogy ventilator is provided by the VEP on a long term loan.
There are other ventilators that can be used for MPV. If you are using another, you would be shown how to use it from your provider. The Trilogy ventilator will be described in this manual.

Figure 3. Trilogy Ventilator https://images.philips.com/is/image/PhilipsConsumer/HC1040005-IMS-en_US?wid=435&hei=245&$pnglarge$

F. MOUTHPIECE VENTILATOR PARTS

When setting up for MPV you will have

- a flexible tapered paediatric tubing (3-6 feet in length)
- A loc-line modular circuit support arm
- Mouthpiece assembly includes an adult, paediatric or tygon tubing
- Bacteria filter

Figure 4. Mouthpiece ventilation circuit. Reproduced with permission from CANVent Ottawa

Figure 5. CANVent arm with MPV circuit inserted http://www.rehabmagazine.ca/healthcare/technology/dont-leave-home-without/

G. MOUTH-PIECE VENTILATION MODES & SETTINGS

The mode used for Mouth-Piece Ventilation is always Assist/Control mode. The settings will be determined by your Doctor and Home Ventilation Team after set-up and trial periods.

H. MOUTH-PIECE VENTILATION ALARMS

The typical alarms set for MPV are:

- **Low Pressure Alarm**
  - For MPV, usually set as low as possible or off
- **High Pressure Alarm**
  - usually set 70 cmH20 to allow you to do breath-stacking and lung volume recruitment techniques
- **Circuit Disconnect or Apnea Alarm**
  - this is set if you cannot go for long periods of time without a breath[3]

I. TRILOGY POWER SOURCES ALTERNATING CURRENT (A/C)

Most of the time, when using MPV at home; your ventilator will be plugged into your home wall outlet which is 120 volts of alternating current (A/C). Always use wall outlet power if you are planning to stay in one place. An A/C power cord comes with the ventilator.

Plugging in the Ventilator to A/C power

1. Plug the socket end of the A/C power cord into the A/C power inlet on the side of the ventilator. To prevent accidental removal of the A/C power cord from the ventilator, you may secure the A/C power cord to the ventilator using the A/C power cord retainer located on the back of the device.
2. Plug the pronged end of the cord into a wall outlet not connected to a wall switch.
3. Ensure that all connections are secure. If A/C power is connected correctly and the device is operating properly, the green A/C LED light should be lit.[1(45), 2(51-52)]

Figure 6. Philips Respironics Trilogy Ventilator https://images.philips.com/is/image/PhilipsConsumer/HC1040005-IMS-en_US

Internal Battery

- The Trilogy ventilator device contains an internal battery that can be used as a backup power source only.
- It is intended for use during short periods while switching between external power sources, emergency situations, or short durations when the user needs to be mobile.
- The length of time the ventilator will operate on internal power depends on the settings, battery charge level, and condition or age of the battery.
- When fully charged, a new battery can power the ventilator for about three hours
- Whenever the ventilator is connected to A/C power, it will automatically recharge the internal battery.
- A completely discharged internal battery will reach 80% charge status within 8 hours when charging.
- If there is no A/C or detachable battery power available, the internal battery symbol will have a black box around it to indicate that it is in use. [2(51-52)]

Detachable Battery Pack

- The VEP offers the Philips Respironics detachable Lithium-Ion battery pack
- To use the detachable battery pack, snap the battery into place on the back of the ventilator.

- When the device is not connected to an A/C power source or an external battery, the detachable battery will power the device, if attached.
- The length of time the ventilator will operate on battery power depends on the settings, battery charge level, and condition or age of the battery. When fully charged, a new battery can power the ventilator for about three hours.
- If you are only using the detachable battery, the detachable battery symbol on the front screen has a black box around it to it is being used.
- When the ventilator is connected to A/C power, it will automatically recharge the detachable battery pack.
- A completely discharged detachable battery will reach 80% charge status within 8 hours.
- Insert and securely latch the detachable battery into the ventilator. One side of the detachable battery has a set of LEDs that indicate the amount of charge left on the battery. You can press the button to view how much of the charge remains.

Completely discharged detachable and internal batteries will take eight hours to recharge.

Power source indicators

Battery	Symbol
Internal battery	
Detachable battery	
External battery	

LED	Battery capacity
LEDs are lit	80-100% capacity
4 LEDs are lit	60-79% capacity
3 LEDs are lit	40-59% capacity
2 LEDS are lit	20-39% capacity
1 LED is lit	10-19% capacity
1 LED flashes	1-9% capacity
0 LEDs are lit	0% capacity

http://www.philips.ca/b-dam/b2bhc/master/whitepapers/treating-restrictive-lung-disease-at-home/1061109_TrilogyWrk shpUS_Booklet.pdf

External Battery

When you are out in the community using MPV, you should run the ventilator off of the detachable battery or have it connected to an external battery. For safety reasons, always travel with your ventilator power cord in case the battery fails and you need to use A/C power. If you have the external battery mounted to the wheelchair, you will need to buy another external battery for emergency backup power. Discuss this with your wheelchair vendor, Occupational Therapist, and Respiratory Therapist.

- The ventilator can operate from a 12V D/C deep cycle marine-type (lead acid) battery using the External Battery Cable provided by the VEP
- The VEP provides an external D/C battery for emergencies such as a power outage. The VEP also provides a battery charger. The battery is a standard 12 volt battery that would provide power to the ventilator for 5-12 hrs. It is not charged through the ventilator.[2(53-56), 7]

IMPORTANT! The external battery should not be used for portability, such as with a wheelchair. It is for emergency backup power only.

How do I hook up the external battery to the ventilator?

1. Check to make sure the battery is fully charged. If it needs charging, charge it first. Never charge the battery while the battery is connected to the ventilator
2. Place the battery in a safe place away from the ventilator's inlet filter (on the back of the ventilator panel). Do not put the battery on top of ventilator
3. Plug the VEP provided battery cable into the proper connection on the ventilator
4. Plug the battery cable into the battery
5. Turn on the ventilator and ensure it is operating correctly.

Figure 8. Trilogy Ventilator with 12V marine battery, battery cable- courtesy of the Ventilator Equipment Pool. March 2017

IMPORTANT! Some internal ventilator batteries may not recharge when the ventilator is plugged into an external D/C battery.

How do I remove the external battery from the ventilator?

1. Unhook the battery cable from the battery
2. Unhook the battery cable from the ventilator
3. Make sure ventilator is plugged into the wall outlet (A/C power source)
4. Recharge the battery in a well ventilated area using the battery charger provided by the VEP [7(46)]

I would like to use my ventilator with my wheelchair. What battery should I use?

A battery is needed when you use your ventilator with your wheelchair. You will need to buy another battery for this purpose. Discuss this with your wheelchair vendor, Occupational Therapist, and Respiratory Therapist.

IMPORTANT! Do not use the external battery that VEP has given you. That one is for emergency use only. VEP does not supply batteries for wheelchair use.

When do I need to recharge the external battery?

- Recharge the battery after every use in a well ventilated area
- Old batteries will lose their charge quickly so check the battery charge every week
- Discharge and recharge the battery monthly [7(46)]

How do I recharge the external battery?

1. Charge the battery in a well ventilated area
2. Do not charge the battery when it is hooked up to the ventilator
3. Use a 12 volt battery charger to recharge the battery
4. Connect the battery to the charger
5. Connect the charger to the wall outlet (A/C power)
6. Let the battery charge. Note: It will take one hour of recharge time for every hour that it was used
7. When the battery is 80% charged, the yellow light will flash
8. When the battery is 90% charged the green light will come on. When the green light is on it means the charge is complete
9. Leave the battery hooked up to the charger for another 3 hours after the green light comes on
10. When the battery is fully charged, unplug the charger from the wall outlet first, before unhooking the charger from the battery

J. CLEANING

If you are using the circuit pictured in **Figure 4**, the only part that will require cleaning is the mouthpiece and connectors up to the filter. The filter protects the circuit from getting dirty, so the circuit is considered clean as long as the filter is changed as needed. Make sure the in-use carrying bag, CANVent arm, and other parts are wiped down with a damp cloth weekly to remove any dust or dirt from outside use.

Figure 9. CANVent arm with MPV circuit inserted
http://www.rehabmagazine.ca/healthcare/technology/dont-leave-home-without/

K. TROUBLESHOOTING

Be sure to review the 'Troubleshooting' **Section** in your ventilator's User's Manual, and then review it with your Respiratory Therapist. We have included some of the more common alarm conditions and causes in the table below. [8]

PROBLEM OR ALARM	POSSIBLE CAUSE	WHAT SHOULD I DO
Low Pressure Alarm (There is not enough air being delivered to the patient)	There is a leak somewhere in the circuit.	Start at the client and look along circuit to ventilator. The circuit could have 'popped' off somewhere. Check that all circuit connections are tight and no air is leaking. If the client is unable to breathe on their own, help them breathe with the resuscitation bag or set them up to the Bilevel device while you look for the leak.[2 (42)]
High Pressure Alarm (There is something 'blocking' the flow of air to the patient)	Ventilator tubing is blocked or kinked	Unkink or unblock ventilator tubing
	You have done LVR and hit the high pressure alarm setting	If you feel that lungs are full after this technique: do nothing. If you are able to take more air in, notify your Respiratory Therapist that the High Pressure Alarm may need to be increased to allow for LVR.
	The client is coughing, hiccupping, or tongue is in the mouthpiece opening	If the client is coughing, they may need a cough assist treatment
Vent IN-OP Alarm (Something is causing the ventilator to not work properly)	Internal Error detected or a condition that may affect ventilation	Disconnect patient from ventilator and deliver breaths with a resuscitation bag. Call the VEP
Circuit Disconnect Alarm	Breathing circuit is disconnected or there is a large leak	Reconnect the breathing circuit or fix the leak

L. SUPPORT & CONTACT INFORMATION

If you are having technical issues with the ventilator, call the VEP or your Respiratory Care Company for support. If you are having trouble with the settings, call your doctor or Respiratory Therapist.

VEP 1-800-633-8977 or 1-613-548-6156

My Respiratory Care Company is: _____

Telephone number: _____

My Respirology Clinic's Telephone Number: _____

M. HOW DO I ORDER PARTS?

The ventilator and the parts required to operate the ventilator (battery, charger, and in-use carrying bag) are supplied at 100% coverage through the Assistive Devices Program, through the VEP. They are on a long term loan to you for as long as required. The VEP will provide you with 12 disposable ventilator MPV circuits every year. The ADP will provide you with an annual grant of money which you can use towards buying masks, mouthpiece parts, connectors, filters and any other items you may need. You may go to any medical vendor for these supplies.[6]

N. REFERENCES

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7. OTHER EQUIPMENT & THERAPIES

Manual Resuscitator Bags

A manual resuscitator bag is also called a "self-inflating" resuscitation bag. This bag is an essential part of the home ventilation equipment. As named, the bag can "self-inflate" and manually ventilate or push air into the lungs. Air can be pushed into the lungs through the tracheostomy tube or through a mask that covers the mouth and nose. Manual resuscitator bags are also referred to as "Bags", "AMBU bags", "Bag-Valve Resuscitation Bags" or "Manual Baggers".[1]

A. PARTS OF THE MANUAL RESUSCITATOR

Figure 1. Manual Resuscitation Bag Dario le Presti Shutter Stock 140022130

1. Patient Adapter to Mask or Tracheostomy tube
2. Bag
3. One Way Intake valve
4. Oxygen Inlet
5. Reservoir Bag

B. WHEN DO I USE THE MANUAL RESUSCITATOR?

A manual resuscitator should be used:

- When the client is having trouble breathing
- If the ventilator is not working or the power supply fails
- To support the client before, during and after suctioning as needed[1]
- As part of lung volume recruitment exercises (see **Section 8: Lung Recruitment & Pulmonary Clearance Techniques**)

Figure 2. Manual Resuscitator ShutterStock 251378227.jpg

C. TESTING THE MANUAL RESUSCITATOR

Test the manual resuscitator and ensure it is working properly every day [1,2]

1. Self-Inflating Test:
   a. Use one hand to squeeze the bag
   b. Keep squeezing the bag and block the patient adapter with the other hand.
   c. Release the bag
   d. Resuscitation bag should quickly refill with air

2. Leak Test:
   a. With one hand block patient adapter and squeeze bag with the other hand.
   b. Bag should remain inflated.
   c. If bag deflates slowly there may be a leak in the bag or valves

IMPORTANT! If there is a leak in the manual resuscitator bag discard and replace immediately [2]

3. If the client has oxygen prescribed or available at home please attach oxygen tubing to oxygen inlet and adjust flow to fill reservoir bag. The reservoir bag should not completely deflate when resuscitator bag is squeezed.

IMPORTANT! Make sure you have a manual resuscitator with you at all times and a spare resuscitator bag at home and in the car as well.

D. HOW DO I USE THE MANUAL RESUSCITATOR?

A manual resuscitator may be used on a tracheostomy tube or a face mask.

Tracheostomy Tube

1. Check function of manual resuscitator (see **Section 7C**)
2. Attach connector to tracheostomy tube directly or with a trach swivel adapter if available
3. If tracheostomy tube has a cuff, be sure to inflate the cuff

IMPORTANT! If a speaking valve is being used, the speaking valve must be removed BEFORE inflating the cuff!

4. With one hand squeeze the bag at a rate of:
   - 12-16 breaths per minute for an adult[2]
5. If client starts to breath, try to squeeze the bag as they breath in (to coordinate with their breaths)
6. Put your other hand on their chest to feel the chest move when you are squeezing the bag
7. Attach oxygen if prescribed and available

Mask

- Check function of manual resuscitator
- Attach face mask to patient adapter
- try to lie the client on his or her back
- If client is in a wheelchair be sure that their head is supported
- Suction mouth if needed
- Place mask over mouth and nose holding tight seal with one hand
- Use your other hand to squeeze the bag
- Squeeze the bag at a rate of :
  - 12-16 breaths per minute for an adult

  If client starts to breath, try to squeeze the bag as they breathe in (to coordinate with their breaths)

- Watch for chest rise as you squeeze the bag
- Attach oxygen if prescribed and available

E. CLEANING THE MANUAL RESUSCITATOR

You may choose to purchase a single patient use disposable manual resuscitation bag and replace as needed. Or, you can choose a single patient, reusable manual resuscitation bag and clean as needed. The disposable bags are less expensive. Before cleaning the manual resuscitator, review the manufacturer's cleaning instructions.[1]

1. Clean the bag at least once per month or when dirty
2. Take the bag apart, checking each part for wear and tear
3. Fill sink/pail with warm soapy water
4. Soak all pieces of the bag for 20 minutes
5. Rinse well
6. Fill sink/pail with 1 part vinegar to 3 parts water and soak pieces again for another 20 minutes
7. Rinse well
8. Dry overnight on clean towel
9. Reassemble pieces of bag as per manufacturer's instructions

IMPORTANT! Be Sure to check bag for leaks and verify function with both tests described in Section 7C before using with client.

F. TROUBLESHOOTING

Figure 3. Bag Mask Ventilation ShutterStock 552719497

IMPORTANT! If the chest is NOT rising and falling or patient colour does not get better:

- Check for leaks. Reposition the mask to make a good seal. Be sure the tracheostomy tube cuff is inflated **(speaking valves have to be taken off before inflating the cuff)**
- Check that you are not squeezing the bag too fast or too slow and adjust as needed. If you are squeezing the bag too many times per minute, you may not be letting the patient breathe out. If you are not squeezing the bag enough times per minute you will not deliver enough air to the lungs.
- Check that there is no obstruction or blockage in the airway or tracheostomy tube and suction if necessary
- If oxygen is available and prescribed, make sure flow is turned ON and that reservoir bag is filling.

G. WHEN DO I GET SUPPORT AND CONTACT INFORMATION?

If you are not sure how to use the self-inflating manual resuscitation bag, work with a Respiratory Therapist to develop this skill prior to discharge from hospital. If you have any difficulty or questions once home, please contact your Respiratory Therapist for more teaching and practice.

IMPORTANT! This will be your "go to" tool for supporting your client's breathing and you must feel confident in this skill.

For information about the bag itself, be sure to read and follow manufacturer instructions.

H. HOW DO I ORDER PARTS?

Take your prescription to the home care vendor of your choice to purchase your self-inflating manual resuscitation bags for home use. Be sure it is the correct size and that you feel comfortable to check its function prior to bringing equipment home. For replacement or additional parts, contact the vendor who will guide you to order the correct parts as needed.

Additional Parts that may be prescribed include:
- PEEP Valve (if needed)
- Oxygen tubing (if not included)

I. REFERENCES

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2. Troini R, Del Sonno P, Client Instruction Emergency Procedures Section 4.2 Manual Resuscitator 2012 National Program for Home Ventilatory Assistance McGill University Health Centre

Humidifiers

A. WHAT DO HUMIDIFIERS DO?

- A humidifier adds moisture to the air that the ventilator pushes into the lungs.[1] It is very important to use humidity as much as possible for both invasive and non-invasive ventilators.
- During invasive ventilation through a tracheostomy tube, the patient (or child's) upper airway has been completely bypassed. When airflow does not pass through the nose and mouth it is not warmed or humidified.
- The warmer the air is, the more moisture it can hold.

- Breathing in warm, moist air keeps mucus thin and loose which means it is easier to cough up. [1,2]
- During Non-invasive ventilation, added humidity is used to overcome dryness in the nose and/or mouth. Constant flow of dry air through the nose and mouth may be irritating. Adding humidity to the delivery system will help to prevent discomfort and keep secretions loose.

B. TYPES OF HUMIDIFIERS

There are three common types of humidifiers: Heated Passover, Heated Passover with Heated Wire Circuit, and the Heat Moisture Exchanger.

What is a Heat Moisture Exchanger (HME)

An HME may also be called a Swedish Nose or artificial nose. The HME is a simple adapter that fits on the tracheostomy or in the ventilator circuit. There is a sponge like filter inside the adapter. The filter traps warmth and moisture when the client breathes out. That moisture is carried back into the lungs with the next breath in.[1]

Figure 4. Heat Moisture Exchanger www.intersurgical.ca/products/airway-management/heat-and-moisture-exchangers-hmes

C. PARTS OF THE PASSOVER HEATED HUMIDIFIER

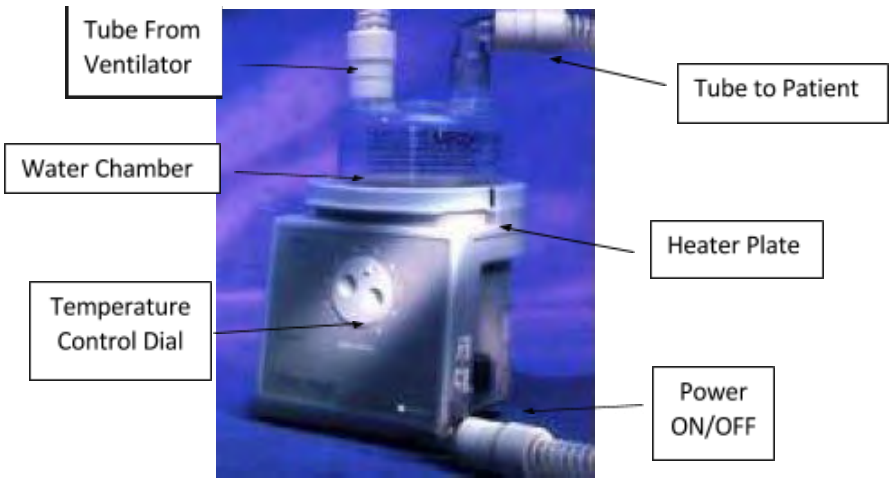

Figure 5 Fisher Paykel MR410 Humidifier http://www.medwow.com/med/nebulizer/fisher_paykel/mr410/18016.model-spec

Air flows from the ventilator into the humidifier water chamber and picks up warm moisture before it flows to client.[1]

D. PARTS OF THE HEATED WIRE CIRCUIT HUMIDIFIER

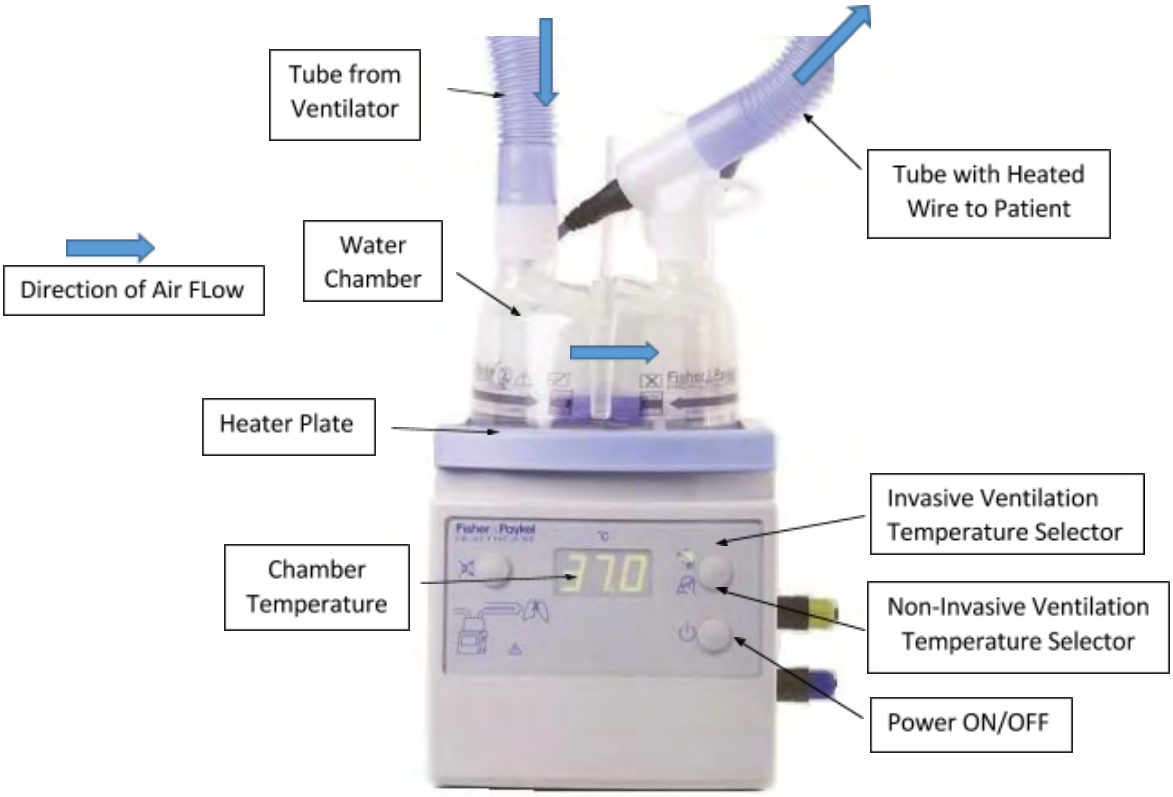

Figure 6. Fisher and Paykel MR850 Humidifier http://bemeseast.com/index.php?route=product/product&product_id=180

Air flows from ventilator into water chamber where it picks up warm moisture and flows through the ventilator circuit tubing to the client. The circuit has a heated wire that keeps the moisture in the air and increases the amount of humidity to the client.[2] We tend to use this circuit in clients who may have very dry secretions and are at risk of mucus plugs.

There are different types of pass-over humidifiers.[1] Some ventilators have the humidifier built-in or as a detachable unit to the actual blower. Some ventilators require stand- alone humidifiers as shown above, but they all work the same way. Be sure to read the User's Manual and review the humidifier that has been given to you.

Figure 7. Stellar 150 with H4i Humidifier
http://www.cpap-online.de/images/ResMed Befeuchter/ResMed_H4i_Bild1.jpg

All humidifier units must have:

- Three pronged wall plug for electrical power
- Water chamber
- Heater control to adjust water temperature
- Heating plate that heats the water

E. HOW DO I USE THE HUMIDIFIER?

Filling the Water Chamber

The humidifier will work best if the water level is kept between the "refill" and "full" line.[1] Do not leave water in the reservoir when the ventilator is not in use.

When ventilator not in use, clean and fill humidifier by taking the following steps:

1. Wash hands
2. Rinse the chamber well and refill with sterile water to full line
3. Reconnect circuit tubing from the ventilator to the humidifier inlet
4. Reconnect circuit tubing to the patient to the humidifier outlet

IMPORTANT! Use only STERILE DISTILLED WATER in your humidifier to prevent infections and/or damage to the humidifier.

If ventilator is in use, clean and fill humidifier by taking the following steps:

1. Wash hands
2. Disconnect the short tube from the ventilator first! (Avoid a nasty face wash!)
3. Disconnect the patient tubing from the humidifier outlet and quickly reattach to ventilator outlet.

IMPORTANT! If patient is not able to tolerate even a short disconnect from the ventilator, have a second person provide manual ventilation with self-inflating bag while you fill water chamber.

4. Throw out any water that is in the chamber
5. Rinse the chamber well and refill to the full line
6. Reconnect patient tubing to humidifier outlet
7. Reconnect short tubing between ventilator outlet and humidifier inlet
8. Check patient to ensure good chest rise and be sure to tighten all connections

Remember not to leave water sitting in the chamber if the ventilator is not in use for periods of time. Be sure to change the water every day and set the humidifier on a flat surface where it cannot be tipped over.

Adjusting the Temperature

Use the temperature controls to increase or decrease the water temperature as needed. If circuit is too dry, increase temperature to achieve desired humidity. If circuit is too wet and there is water pooling in the circuit, be sure to turn down the temperature.
Move any drafts (i.e. fans, heaters) away from the circuit.[1]

F. CLEANING THE HUMIDIFIER

1. Unplug the humidifier from electrical outlet
2. Clean the humidifier using a damp cloth and any gentle dishwashing soap
3. Wipe the humidifier clean of any cleaning residue
4. Wipe the temperature probes and wires clean
5. Rinse water chamber well
6. Wash with gentle dishwashing soap
7. Rinse well
8. Soak in 1 part vinegar to 3 parts water for 20 minutes
9. Rinse well
10. Place on clean towel to dry overnight

G TROUBLESHOOTING

Water may cool in the patient circuit and cause pooling of water in gravity dependent "U shaped" bends of the circuit. This can affect how the ventilator works and affect how airflow is delivered to the client. Water collecting in a warm circuit is a favorable environment for germs to grow in and may lead to an infection.[1]

If there is a water trap in the patient circuit, empty it as needed. When the water trap is removed from the circuit, there isn't a leak created and no need to manually ventilate or disconnect ventilator circuit

If there is no water trap in the patient circuit then you will need to disconnect the circuit to drain excess water:

IMPORTANT! Do not drain water back into humidifier!
Have someone manually ventilate with self inflating bag as necessary while circuit is being drained.

1. Wash your hands and disconnect ventilator tubing from tracheostomy tube (or mask if on non-invasive ventilation, remove mask from face and have someone support patient's breathing as required).
2. Disconnect ventilator tubing from humidifier outlet
3. Empty the tubing by stretching it out and letting water drain into a container.
4. Reconnect to humidifier outlet
5. Remove the tubing from the ventilator outlet and humidifier inlet
6. Empty tubing by stretching it out and letting water drain into a container.

IMPORTANT! Do not shake tubing and spray water out into the air as it may spread germs

7. Reconnect tubing between ventilator and humidifier inlet.
8. Reconnect tubing from humidifier outlet to patient tracheostomy tube or mask

H. Where do I get support and Contact Information

Be sure you are comfortable with the set-up and function of the humidifier given to you for use at home. If you have questions about setting up the humidifier please contact the VEP for assistance and/or the Respiratory Therapist working with the Home Ventilation Team.

I. HOW DO I ORDER PARTS?

You may choose to make your own sterile distilled water or purchase it from your local grocer or pharmacy.

Any other parts that have been supplied to be used with the humidifier would be ordered from the Ventilator Equipment Pool. Please call for replacement parts.

J. REFERENCES

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Pulse Oximeters

A WHAT IS A PULSE OXIMETER?

A pulse oximeter measures two things: oxygen saturation and pulse rate. Pulse oximetry measures the concentration of oxygen in the blood. This is a non-invasive, painless way to monitor how the lungs and heart are working.

A sensor is placed on a finger, toe, or earlobe. The sensor uses red and infra-red light to measure how much oxygen is being carried in the blood and compares it with how much oxygen could be carried. This is measured in percentage (%). If you are to wear an oximeter, your Doctor has ordered an oxygen saturation goal. This is a range or a lower limit that your oxygen saturations should be equal to or above.

The probe is designed to shine light on the finger, toe, or earlobe, and detect the light on the other side. The oximeter also shows a pulse rate. The pulse is how often your heart beats in one minute. Heart rate is measured in beats per minute (bpm). It is normal for a heart rate to go up and down to a certain degree. You should be aware of your normal heart rate range so you know when something is wrong.

My Normal SpO_2 range is: _____ (%)

My Normail Heart Range is: _____(bpm)

B. WHEN DO I USE A PULSE OXIMETER?

Home oximetry is ordered for different reasons. For example, some are to wear the oximeter at night, others, while not attended, some as often as possible, and some just for spot checks. Make sure you know when you are to wear the oximeter. Ask your Doctor if you are unsure.

I am to wear the oximeter during these times:

_____

C. PULSE OXIMETER TYPES

There are different types of pulse oximeters. Some are capable of recording data that can be reviewed by your doctor. Other models are simple finger clips that are small and very portable.

Figure 8. www.omniordering.com/images/RMIPOX2D.jpg?osCsid=7p8s31ecc22fcebrg0gbkmel36

Be sure to review your machine's User's Manual. For those who qualify, the VEP provides the Massimo Rad8 Oximeter.

Figure 9. Rad-8 Pulse Oximeter.www.dufortlavigne.com/en/produit/MAM9190

D. PARTS OF THE PULSE OXIMETER

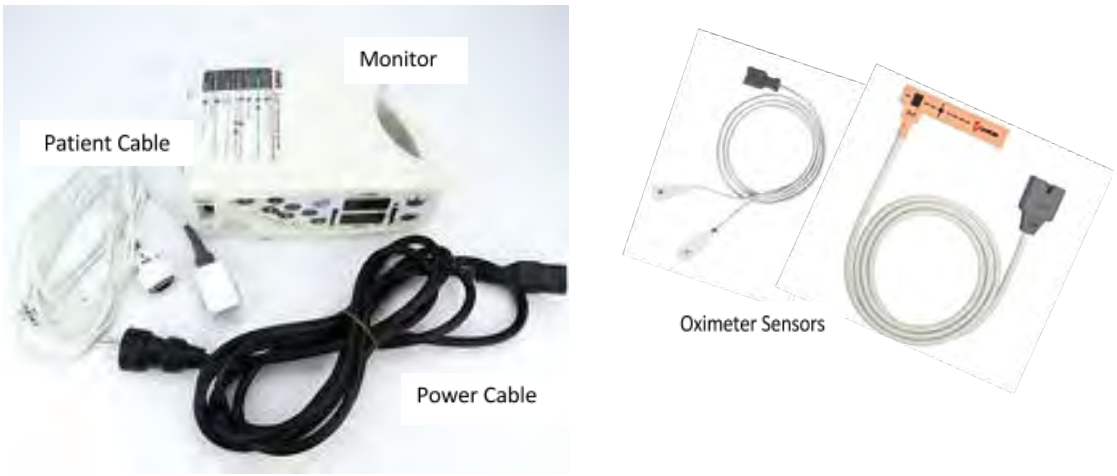

Figure 10. Massimo Rad8 Pulse Oximeter. www.colonialmed.com/images/Product/medium/7414.jpg

Review the parts that come with your Pulse Oximeter in its User Manual.

E. PULSE OXIMETER PARAMETERS

A home oxygen saturation monitor may be prescribed by your doctor.
A typical prescription will give parameters or alarm settings to alert you to check your client.
The prescription will list the safe ranges for both heart rate (HR) and SpO_2

My Home Oximeter Prescription:

High SpO_2 _____ %
Low SpO_2 _____ %
High HR _____ beats per minute (bpm)
Low HR _____ beats per minute (bpm)

If you are unsure of your prescription, ask your Doctor.

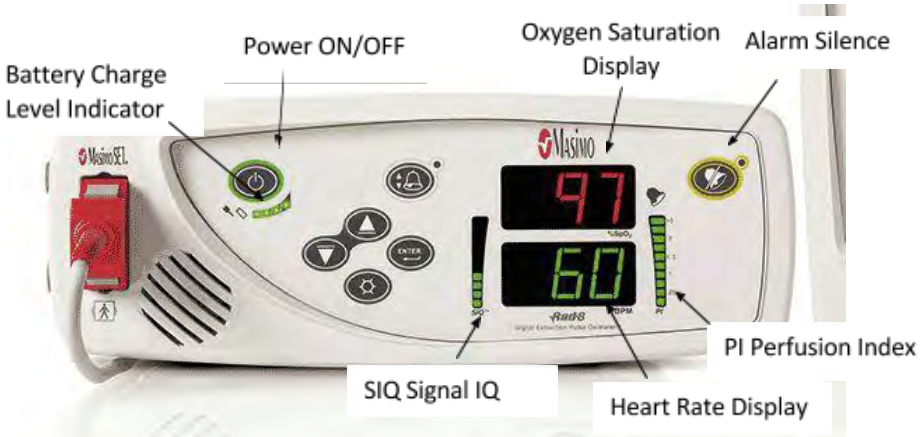

Figure 11. Masimo Rad8 Pulse Oximeter. www.dufortlavigne.com/en/produit/MAM9190

Two other important parameters that help to assess how accurate the reading is are:

1. Signal Bar IQ (SIQ)
2. Perfusion Index (PI)

Signal IQ (SIQ)

- An LED bar indicator that bounces up and down with the pulse. It indicates the strength of the pulse being sensed
- the stronger the pulse, the higher the bar signal, the more accurate the reading
- The weaker the pulse signal, the shorter the bounce of the bar. This means that the oxygen saturation reading may not be as accurate
- The Signal IQ may alarm if the displayed SpO2 is not a good signal
- the Signal IQ bar indicator can be used to determine if the SpO2 reading is accurate or not

HIGH BOUNCING Signal IQ Bar	LOW BOUNCING Signal IQ Bar
Strong Pulse Signal	Weak Pulse Signal
Reading Likely Accurate	Reading Probably Inaccurate

Perfusion Index (PI)

- another LED bar graph indicator
- gives a percentage (%) of pulse strength
- Range is 0.02-20%
- Values over 1.0% are considered a good pulse strength
- The Perfusion Index can help you determine which site has good blood flow to get an accurate reading
- The PI helps you determine where to put the sensor

F. HOW TO APPLY THE PULSE OXIMETER

1. Connect the patient cable to the monitor.
2. Choose appropriate patient sensor and refer to directions for use before attaching to patient.[1]
   a. Adhesive
   b. Finger Clip
   c. Reusable
3. For any of the above check that the red light and the detector are aligned properly. The detector must be opposite to light source. Remove any dirt, nail polish or other material that may block the signal.

Figure 12. Pulse Oximeter Patient Sensors.
www.tri-anim.com/flexi-form-iii-pulse-oximeter-sensors-group-31220-3823.aspx?search=617-7000 A

4. Press the power button to turn on monitor
5. Wait for monitor to verify settings and pick up signal from probe
6. Monitor patient
7. Change the sensor location every 4 hours and as needed (change if there are changes in skin colour, skin breakdown, or discomfort at sensor site)

G. PULSE OXIMETRY ALARMS

Check to be sure alarms are set as prescribed. Do not change the alarm settings.

IMPORTANT! Alarms are set to warn you of an unsafe situation, be sure to respond right away.

If the client is in no distress and looking well but SpO2 is alarming low, check the probe and site, and reposition as needed to get a more accurate reading.

My Home Oximeter Alarm Settings are:

High SpO_2 _____ %
Low SpO_2 _____ %
High HR _____ beats per minute (bpm)
Low HR _____ beats per minute (bpm)

H. POWER SOURCES AND BATTERY USE

Please review your oximeter's User's Manual.

Massimo Rad8 Oximeter[1] :

- The battery should be fully charged before first use. Plug the battery into A/C power outlet
- the battery takes 8 hours to fully charge
- the Battery Charge Bar indicator illuminates green from left to right to show the amount of battery charge when unplugged
- the battery life is up to 7 hours
- Keep the battery charged to make sure that you have backup power if there is a power loss

I. CLEANING THE PULSE OXIMETER

1. Remove sensor from the patient
2. Disconnect sensor from the patient cable
3. Disconnect the patient cable from the monitor
4. Wipe down monitor with soft damp cloth.
5. Do not let liquids enter the oximeter.
6. Wipe the entire sensor (reusable) and patient cable clean with alcohol wipe.
7. Allow to air dry before reconnecting to monitor

J. TROUBLESHOOTING[1]

PROBLEM	POSSIBLE REASON	WHAT DO I DO?
SpO_2 does not match clinical assessment	- Not enough blood flow to probe site, - Probe not on properly	Check probe and reapply or change site
Pulse Search Message	Monitor is looking for pulse	- If no reading after 30 seconds, disconnect and reconnect probe - Change site
Difficult to Read or No SpO_2 Reading	Low battery and no A/C power supply	Connect power supply
	Wrong sensor or wrong sensor size	Check to be sure sensor fits properly
PI Bar Turns Red Low Perfusion	- Wrong Type of Sensor - Lack of Blood Flow to Site - Sensor is too tight - Sensor is damaged	- Check probe to be sure it is right size for patient - Be sure probe is not on too tight - Warm sensor site - Change Site
Low SIQ Signal Quality	- Wrong Type of Sensor - To much motion - Lack of blood flow to the site - Sensor or Cable is damaged	- Check to be sure probe is the right size and on properly. - Check that site is warm - Reapply sensor - Change Site - Replace sensor - Replace patient cable

K. WHERE DO I GET SUPPORT AND CONTACT INFORMATION?

If the client is in distress and the SpO_2 is low or you have concerns about clinical changes please contact your Doctor and or call 911 as appropriate.

For technical problems please contact the vendor where the oximeter was rented or purchased from. If the monitor was funded through the ADP please contact the Ventilator Equipment Pool for technical issues.

L. HOW DO I ORDER PARTS?

Contact vendor for more probes and other replacement parts.
If under 18 and have been funded for a monitor please call the VEP for probes and replacement parts

M. REFERENCES

1. Ontario Ventilator Equipment Pool Website Copyright 2014 ontvep.ca/w/wp-content/uploads/2014/05/Masimo-Rad-8-User-Manual.pdf Accessed April 2017

Inhaled Medications

A. TYPES OF INHALED MEDICATIONS AND WHAT THEY DO

Inhaled medications are breathed directly into the lungs. Two common types of inhaled medications are:

Bronchodilators
Act to open the small airways and improve air entry into the lungs.

Anti-inflammatories
Act to reduce irritation and swelling of the lining of the airways to improve air entry into the lungs.

B. GIVING INHALED MEDICATIONS

A Metered Dose Inhaler (MDI) or "Puffer" May be given by:

1. An aerochamber with mask or mouthpiece interface

Figure 13. Aerochamber with Mouthpiece. Shutterstock 390727801.

2. An aerochamber that fits in line with ventilator circuit

Figure 14. Aerovent Plus https://www.monaghanmed.com/AeroVent-Plus-CHC

How Do I Deliver a Puffer to a Client on a Ventilator1?

1. Check to make sure you are giving the prescribed medication and know the correct dose.
2. Check expiry date on canister
3. Place the chamber into the inspiratory side of the ventilator circuit
4. If there is an HME in line, take it out
5. Shake the canister well
6. Insert canister into the chamber adaptor
7. Press down on the canister to deliver the medication as the patient is breathing in
8. Remove the canister and put the cap back on the port so there is no leak
9. Wait 30 seconds in between puffs.
10. Repeat steps 5-8 as prescribed.

C. HOW DO I ORDER PARTS?

Aerochambers may be purchased at your local pharmacy. For an Aerovent or other in-line chamber made for delivering puffers to a ventilated patient, contact your vendor for other ventilator connectors and disposables.

Aerochambers should be cleaned once a week with mild dish soap and warm water. Rinse well and let air dry. If on a ventilator, clean the aerochamber when you clean the circuit.

D. REFERENCES

1. Bayliss M, Hamp C, Johnson D, et al. Ontario, Canada. June 2010. Optimizing Respiratory Therapy Services. A Continuum of Care from Hospital to Home. Patent/Clients and Caregivers

8 LUNG VOLUME RECRUITMENT & LUNG SECRETION CLEARANCE TECHNIQUES

In this **Section** of the manual, we will discuss how to prevent your lungs from collapsing, how to strengthen your cough, and how to keep your lungs clear from mucus build-up.

A. WHY IS LUNG RECRUITMENT & SECRETION CLEARANCE IMPORTANT?

When your lungs are healthy and clear of mucus, you will be able to breathe more air into and out of your lungs. To keep your lungs clear of mucus, you must have a strong cough. Having a strong cough and being able to breathe more air into and out of your lungs will help you bring enough oxygen into your lungs and your body. It will also help with speaking, help prevent your lungs from collapsing, and help prevent lung infections[1]

A strong cough is important so you can remove mucus from your lungs. If you have weak respiratory muscles you may not be able to cough out your mucus, which could result in a serious lung infection. For a strong cough you need two things:

1. To be able to completely fill your lungs
2. To be able to breathe out forcefully

There are ways to help you if your muscles are too weak to get the big breath in and cough forcefully enough to clear secretions. This section lists several methods and exercises to help improve your cough. If you use these exercises daily, you will be able move the mucus up from the airway into your throat or mouth where it can be suctioned or spit out. Doing these exercises daily will help keep your lungs clear and prevent collapse.

We will discuss the breathing exercises to keep your lungs healthy. These include: Lung Volume Recruitment (LVR) techniques using a resuscitation bag, insufflation/exsufflation using the Cough Assist E70 machine, manually assisted coughs (MAC), and using a portable suction machine for suctioning.

B. LUNG VOLUME RECRUITMENT & BREATH-STACKING

Lung Volume Recruitment (LVR) is a breathing exercise using a hand-held, self inflating, manual resuscitator bag, to stack a breath one on top of the other until your lungs feel full. It is a useful tool if you have a neuromuscular disease or spinal cord injury causing weak breathing muscles. Doing breath-stacking daily will allow you to increase the size of your breaths beyond what you would be able to take in on your own. With this extra volume of air in your lungs, your cough will be stronger so you can clear your airways and prevent lung infections. The bigger breaths will also help you blow your nose and have a louder speaking voice. [1,2,3,4]

It is important to know when NOT to perform LVR exercises. Do NOT do LVR exercises if you have the following conditions:

- Severe chronic obstructive pulmonary disease (COPD)
- Low blood pressure
- Coughing up blood
- You have an **inflated** tracheostomy cuff or endotracheal tube[2]

Figure 1. http://www.mercurymed.com/product-category/airway-clearance-devices/

Figure 2. CANVent Ottawa Web site. http://canventottawa.ca/ (used with permission)

Perform LVR exercises as prescribed or at least 4 times per day. To perform LVR, squeeze the bag 3-5 times until you feel that your lungs are full to the maximum. Do not keep squeezing the bag if you feel you have reached your maximum as it may cause lung damage. You may want to perform LVR more frequently when you feel more congested than normal, but no more than every 10 minutes to avoid hyperventilating and dizziness.[2(3),3]

IMPORTANT! Never use the LVR bag for rescue breathing!

How do you use the LVR bag?

1. Check that all the LVR bag parts fit tightly and are assembled correctly.
2. You can use the LVR bag when sitting upright or lying on your back.
3. If someone is helping you, agree on a signal so you can let your helper know when your lungs feel full (blinking is a good way)

4. Put on the nose clips. Take your own deep breath before putting your mouth around the mouthpiece and making a tight seal with your lips.
5. Breathe "in" through the mouthpiece as you gently squeeze the bag at the same time. Breathe in again though the mouthpiece as you again gently squeeze the bag, breath-stacking each breath on top of the other until your lungs feel full. You should feel a gentle stretch in your chest, not pain or discomfort.
6. Once your lungs are full, take the mouthpiece out of your mouth, hold your breath 3-5 seconds and then gently let the air out.
7. Once your breaths are stacked, if you have mucus to clear, let the air out as a cough. You can also send the stacked air out your nose to blow your nose with a tissue.
8. Repeat 3-5 times in one session.

What If My Client Cannot Maintain A Seal With The Mouthpiece?

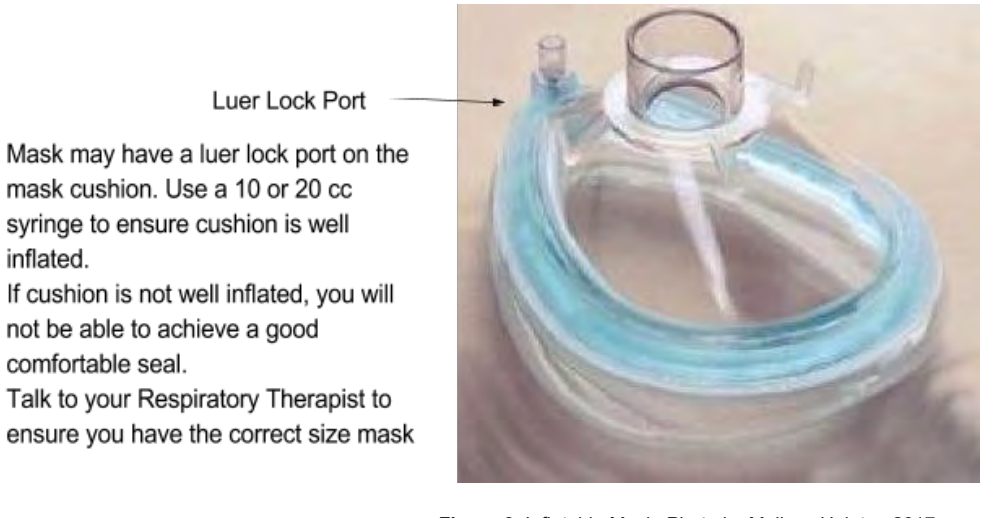

Figure 3. Inflatable Mask. Photo by Melissa Heletea 2017

LVR With A Mask

Initially, you may need to practice maintaining a seal with an inflatable mask alongside your Respiratory Therapist. Please see some tips for performing LVR with a mask below:

1. Make sure you choose the correct mask size. The mask should fit over bridge of the nose and into chin crease (be careful to never apply pressure over the eyes)
2. Place mask over mouth and the scoop bottom of mask cushion into chin crease while pulling the face into the mask
3. Ensure that the head and neck are supported well, using headrest on back of wheelchair or by having another person support firmly in their hands.
4. Keep head in a neutral position. Do NOT hyperextend (tilt chin up and too far back) or flex (push chin down) the neck too much.

THIS SKILL TAKES PRACTICE! TRY NOT TO GET DISCOURAGED.

WARNING:

You will have 2 manual resuscitation bags, or breathing bags. One will be modified and for the LVR exercises, and will be clearly marked **"NOT FOR RESUSCITATION"**. This bag can never be used for breathing emergencies because it has been modified to have a one-way valve attached to it. This means, you can only breathe in with the bag attached, you cannot breathe out. Therefore, using the LVR bag for breathing emergencies or to help you breathe is very dangerous and can cause lung damage and even death. The LVR bag should only be used for breath-stacking. The other resuscitation bag you are provided with will be used in case of a breathing emergency. It does not have a one-way valve attached and therefore, you can breathe in and out with it. This bag is to be used to help you breathe during emergencies or difficulties catching your breath. Please note this difference and ensure everyone involved with the client's care is aware of the differences as well![3(2)]

How Do I Get an LVR Bag?

Your Doctor will prescribe LVR if needed. The prescription can be used to claim the LVR bag through ADP and if you have insurance. Most oxygen vendors will be familiar with LVR bags and can sell you the LVR kit. It is best to call the vendor directly and verify they have it in stock.

* Visit the CANVent website and watch a video demonstration on LVR: http://canventottawa.ca

I am to perform LVR breathe-stacking _____ times per day and as needed

C. COUGH ASSIST DEVICE

What is the Cough Assist?

The Cough Assist, or "cough machine," uses mechanical power to help you cough and bring up mucus from your lungs. You may hear it also called the mechanical insufflation-exsufflation machine (MI-E). This device is helpful if you have neuromuscular respiratory muscle weakness or a spinal cord injury that limits your ability to cough well. It uses a mask, or trach connector, and breathing hose to non-invasively fill both of your lungs with air until they are full and then quickly reverses to pull or "vacuum" the air and mucus from your lungs evenly. The Cough Assist mimics the same thing that we do when we cough: take a big breath in and then forcibly cough the air and mucus out. Because it is used non-invasively, there a lower risk of damaging the wall of your lungs than regular suctioning.[1,5,6]

Your doctor will prescribe the Cough Assist machine and a healthcare provider will set the machine up with your comfort in mind. If you qualify, it is provided to you on a long term loan from the VEP. There are several different versions of the MI-E still on the market. The VEP provides the Philips Respironics Cough Assist E70 unit to its clients.

Figure 4. Philips Respironics Cough Assist E 70 http://ontvep.ca/w/vep-news/philips-e70-coughassist-2/

Cough Assist Parts

The following parts are provided by the VEP to those who qualify:

- Core Package
- CoughAssist E70 Device
- Patient Circuit, including bacteria filter, 6 ft (1.83 m) flexible tubing, and Adult Large Mask
- Carrying Case
- AC Power Cord
- Air Filter
- Hose Clip
- SD Card
- User's Manual
- Detachable battery

Cough Assist Modes

The Cough Assist E70 unit has two modes available:

1. **Auto Mode**
   In Auto Mode, the unit automatically delivers the set inhale and exhale pressures within the set inhale and exhale time. The sequence is repeated until the patient stops and exits the therapy state.

2. **Manual Mode**
   In Manual Mode, the user manually toggles a switch and delivers the set insufflation pressure for the amount of time that the manual switch is held in that position and delivers the exsufflation setting for the time the switch is held in the exsufflation setting. This requires caregiver-client co-ordination for the treatment.[7]

In whichever mode is selected, you will be able to see the pressure delivered on each inhale and exhale. The inhale pressure will be represented by a blue bar and the exhale pressure by a yellow bar. If you do not see the coloured bar meet the set pressure, you will know there is a leak (usually at the face and mask).

Your Healthcare Provider will determine the best mode for you.

Cough Assist Settings

The Cough Assist E70 unit has 3 possible preset prescriptions. They are:

- Preset 1: "Daily, Routine Use"
- Preset 2: "Use if increased secretions"
- Preset 3: "Emergency"

The Cough Assist E70 has two therapy features:

- **Oscillation Therapy**
  - This delivers vibrations to the inhale and/or exhale pressures to help with loosening and moving secretions so they may be easier to cough up or suction out

- **Cough-Trak**
  - When set, the treatment will be triggered when the client takes a breath in or makes a breathing effort. This feature helps synchronize the therapy with the client.

The Cough Assist settings will be set by your Healthcare Provider. The goal is to get the best secretion clearance while keeping comfortable and safe settings.

Cough Assist Power Sources

The Cough Assist battery also works with the Trilogy ventilator. The battery gives enough power for up to 4 treatments on a single charge.[7]

Detachable Battery Pack

- The VEP offers the Philips Respironics detachable Lithium-Ion battery pack
  To use the detachable battery pack, snap the battery into place on the back of the Cough Assist machine
- When the device is not connected to an A/C power source or an external battery, the detachable battery will power the device, if attached.
- The length of time the cough assist machine will operate on battery power depends on the settings, battery charge level, and condition or age of the battery. When fully charged, a new battery can power 4 treatments on a single charge.[7]
- If you are only using the detachable battery, the detachable battery symbol on the front screen has a black box around it to it is being used.
- When the ventilator is connected to A/C power, it will automatically recharge the detachable battery pack.
- A completely discharged detachable battery will reach 80% charge status within 8 hours.
- Insert and securely latch the detachable battery into the cough assist machine. One side of the detachable battery has a set of LEDs that indicate the amount of charge left on the battery. You can press the button to view how much of the charge remains.

Completely discharged detachable and internal batteries will take eight hours to recharge.

Power source indicators

Battery	Symbol
Internal battery	
Detachable battery	
External battery	

LED	Battery capacity
LEDs are lit	80-100% capacity
4 LEDs are lit	60-79% capacity
3 LEDs are lit	40-59% capacity
2 LEDS are lit	20-39% capacity
1 LED is lit	10-19% capacity
1 LED flashes	1-9% capacity
0 LEDs are lit	0% capacity

Figure 5. Power indicators and Trilogy detachable battery
http://www.philips.ca/b-dam/b2bhc/master/whitepapers/treating-restrictive-lung-disease-at-home/1061109_Trilogy-Wrk shpUS_Booklet.pdf

Cough Assist Treatment

Figure 6. Cough Assist by mask. http://respicare.ph/product/coughassist-e70/

Always ensure that you are using the correct preset prescription on your machine and that the pressure settings are correct. Apply the cough machine for at least 2-3 therapy sessions per day with 3-5 insufflation-exsufflation (in and out) cycles at each session. If you have more mucus in your lungs than usual, you may need to use the Cough Assist more often. Give yourself short rest periods to avoid any dizziness. Unless it is an emergency, it is best to do this treatment before meals.[4,6] The hardest part of the treatment will be keeping a tight seal with the mask against the face. If there are leaks, the pressure will leak out around the mask and you will not get the correct amount of pressure. Not having the prescribed pressure may mean that the treatment won't work as well at clearing mucus.

The Cough Assist machine may also be used with a tracheostomy. If you have a trach, you will you need a tracheostomy connector to attach to the end of the trach.
It is best to perform MI-E with an inflated cuff. Performing MI-E with an inflated trach cuff will minimize leaks and allows the pressures to reach therapeutic pressures.[4,6]

- Add one or several 6-inch large bore tubing with tracheostomy connectors fitted securely to the MI-E circuit to help trap secretions. The 6-inch tubing can be thrown out if and when secretions collect in it with treatments.
- Hold the tubing end like a pencil to allow for easy disconnection. [6]

Figure 7. Cough Assist E70 used through a trach
http://www.philips.ca/healthcare/product/HC1098159/cough-assist-e70-ventilation

- Before beginning, agree on a sign that the client can give when he/she has received the maximum amount of air (e.g., blinking)
- Make eye contact with the client receiving the Cough Assist treatment

Treatment Procedure in Auto Mode

- Attach the appropriate patient interface to the device.
- Press the Power On/Power Off button to turn the device on.
- Check your settings before starting therapy.
- Attach the appropriate patient interface to the patient.
- Press the 'Therapy' button to start therapy.
- The device will automatically cycle from Inhale (positive pressure) to Exhale (negative pressure)
  to Pause (normal room pressure), and back to positive.
- After the necessary cycles are completed, disconnect the patient from the device, and clear secretions that may have become visible in the mouth, throat, tracheostomy tube, or endotracheal tube.
- Repeat as you have been advised to

Figure 8. Mask and Cough Assist E70 http://www.usa.philips.com/healthcare/articles/restrictive-lung-disease-care

Treatment Procedure in Manual Mode

- Attach appropriate interface to the device
- Press the Power On/Power Off button to turn on the device
- Check your settings before starting therapy
- Press 'Therapy' button to start therapy
- Shift the Manual button to the Inhale position + (to the right) to insufflate
- Say " IN, IN, IN "
- Rapidly shift the Manual button to the Exhale position - (to the left) to exsufflate
- Say "Cough, Out, Out"
- Leave the Manual button in the middle (neutral) position for a moment or rapidly shift immediately back to the inhale pressure for another cycle
- Repeat cycle 3-4 times and then disconnect the patient from the device and clear any secretions that may have become visible in the mouth, throat, and tracheostomy tube.
- Repeat as advised

IMPORTANT! Do not use the device when it's in the carrying bag. Place the device on a hard surface when you're using it (not on a towel or cloth).

I am to perform Insufflation/Exsufflation (In/Ex) using my Cough Assist Machine _____ times per day and as needed

Cleaning

After use, the mask, trach connectors, and tubing should be washed with mild dishwashing soap and water. Dry them completely before next use.

The Bacteria filter which must be used with a VEP Cough Assist unit can be left in place as long as it does not get wet or have any secretions in it. Do not wash this filter. It must be replaced as it is disposable.[6,7]

How do I Order Parts?

The Assistive Devices Program (ADP) will provide eligible Ontario residents with grant money that can be used for buying replacement tubing, masks, connectors and filters.[10] You may be able to get these parts at a respiratory equipment vendor.

*Visit the CANVent website to watch a video demonstration on the Cough Assist E70: http://canventottawa.ca

D. MANUALLY ASSISTED COUGH

Manually assisted cough (MAC) is a technique used to improve the strength of the cough. The technique uses a helper's strong arms to assist weak abdominal and breathing muscles. Manually Assisted Coughs may be helpful if you have a neuromuscular disease or spinal cord injury causing weak breathing muscles. This force is applied to your abdomen when your lungs are

inflated, after a big breath in. This will help with the strength of your cough to clear mucus and secretions from the lungs. If you cannot take a full breath in, you may be able to use the LVR technique to increase the volume of air in your lungs, and then use the MAC to produce a good cough.[8]

You can do MAC once or twice a day and more often when you are more congested. It is best to do MAC before you eat and at bedtime to avoid any stomach content upset.[4,8]

The following MAC techniques are the most common:

1. Abdominal thrust
2. Lateral Costal Compression (side by side rib squeeze)
3. Self assisted cough

Regardless of which MAC technique used, you should:

- Sit with your buttocks as far back in the chair as possible
- Your head and back should be fully supported by a pillow or rolled towel
- If you use a wheelchair, it is important to lock the wheelchair against a wall to preventing tipping, lock the brakes, get hips as far back in the chair as possible, and use a headrest, or rolled towel, to support the head.[4(12-13), 8]

Figure 9. Assisted Cough using abdominal thrust with LVR - picture used with permission from CANVent Ottawa

Figure 10. Assisted cough using lateral costal Compression https://myhealth.alberta.ca/Health/Pages/conditions.aspx?hwid=ug2709

Manual Assisted Cough: Abdominal Thrust Technique:

Firstly, the Helper gets in the following position:

- Place your index fingers on the client's hip bones
- Slide your thumbs towards the client's belly button
- Place the heel of one your hands, one inch above the client's belly button
- Place your other hand on top of your first hand with fingers interlocked with straight elbows, and fingers away from the client's ribs or chest.

1. Once your Helper is in position, take a deep breath, or add as much air as possible to your lungs using an LVR technique.
2. When your lungs feel full, hold your breath.
3. At your Helper's command of "cough", start a strong cough while your helper applies one quick, forceful push inward and upward through the abdomen.
4. The helper must shift their body weight forward with straight elbows.

If the thrust is not strong enough, mucus may be difficult to cough or spit from your throat or lungs.

5. Spit out and wipe the mucus with a tissue or remove with a suction tip.
6. Repeat the procedure two to three times, as needed

Do not use abdominal thrusts if the client has the following conditions:

- Abdominal Aneurysm
  - abdominal aortic aneurysm is an enlarged area in the lower part of the aorta, the maj or blood vessel that supplies blood to the body
- Acute Bleeding Ulcer
  - open sores in the upper part of the digestive tract that can cause stomach pain, stomach upset, or internal bleeding
- Pregnancy
- Recent abdominal surgery

Consult your Doctor if you have the following:

- Vena cava filter
  - A vena cava filter is a device placed into a major vein to prevent a blood clot from entering the lungs; the thrust may dislodge the filter
- New feeding tube: inserted less than 48 hours ago.

Manual Assisted Cough: Lateral Costal Compression Technique

This technique is **not** recommended if you have a significant curvature of the spine, rib cage injuries, osteoporosis, or if you have had recent chest surgery.[4,8]

1. You can be sitting or lying down.
2. If you require the LVR device to inhale and hold a deep breath, you will need a second helper because your first helper will need both hands for the compression.
3. The first helper positions their hands on either side of your lower rib cage with their thumbs in the front of your chest, pointed toward your breastbone.

4. Fill your lungs with as much air as you can hold (using the breath stacking device, if necessary).
5. Your helper (with their hands on your rib cage) instructs you to cough while rapidly pushing inward and upward on both sides of your chest. It often takes more than one maneuver to get results.
6. Spit out and wipe the mucus with a tissue or remove it with a suction tip
7. Repeat the procedure two to three times, as needed

Manually Assisted Cough: Individual Self-Assisted Cough Technique

You must have strong arms and good balance to do the self-assisted cough technique. Tie your seat belt if you use a wheelchair.[4]

1. Sit comfortably; fold your arms over your abdomen below your rib cage. Hold one wrist with the other hand at your middle
2. Take a deep breath or add as much air as possible to your lungs using an LVR technique.
3. When your lungs feel full, hold your breath. As you begin to cough, throw your upper body forward over your arms while hugging the abdomen. This helps push your diaphragm upward to add an extra push to force the air out of your lungs and make a stronger cough.
4. Spit out and wipe the mucus with a tissue or remove with a suction tip.
5. Repeat the procedure two to three times, as needed.

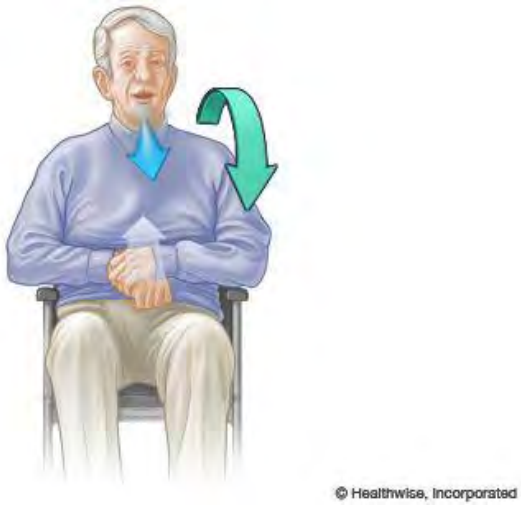

Figure 11. Self-Assisted Cough http://muscle.ca/wp-content/uploads/2012/11/RC13guide-E.pdf

* Visit the CANVent website to watch a video demonstration on MAC. http://canventottawa.ca

I am to do a Lung Volume Recruitment maneuver then a Manually Assisted Cough _____ times per day and as needed.

E. SUCTIONING

i. When Do I Need To Suction?

Suctioning is a way to remove mucus from the trach tube and helps keep it clear so you can breathe easily. Suctioning is done with a smaller tube called a 'catheter' placed inside your trach tube. The suction catheter is attached to a suction machine that allows the catheter to provide sucking, or suction. The catheter will suction out the mucus from the lungs.

Most people will get suctioned as needed. This might be once or twice a day or sometimes more frequently, especially if they have an infection. You will make it a part of your daily routine. For example, your routine may include suctioning first thing in the morning, or just before bedtime. Try and avoid suctioning too frequently. Suctioning too frequently will produce more secretions, may damage the airways in the lungs, and cause bleeding.[6]

Suctioning may be required if:

- You hear mucus rattling while breathing or you see secretions bubbling at the trach opening
- You are unable to cough the mucus up and out of your lungs
- You are on a breathing machine (ventilator) and the airway pressures are higher than usual
- You are having trouble breathing or are breathing faster than normal
- There is a drop in oxygen saturation

A suctioning routine could be:

- Suctioning first thing in the morning
- Suctioning before bed
- Suctioning before and after feeding/meals
- Suctioning before and after any procedures (trach changes etc.)

Find a suctioning routine that works best for you.

My suctioning routine is:

_____

_____

_____

_____

_____

as needed.

ii. Setting-Up the Portable Suction Equipment

Suctioning is considered a clean process, not a sterile process. You should try to keep the area and procedure as clean as possible. Try to avoid having germs enter into the trach as they can cause a lung infection. You or the person doing the suctioning may wear a mask and gloves so that the mucus and germs are not transferred to them.[3(33-37),9(7-8)]

Figure 12. Devilbiss Home Suction Machine. http://www.devilbisshealthcare.com/products/suction-therapy/home

Make sure you know what pressure you are to set the suction unit at. Using too high a pressure can cause damage to the airways and using too low a pressure will make it difficult to suction the mucus out. It is also important to use the right size of suction catheters. If you are unsure, ask your Respiratory Therapist or home care vendor.

My suction unit pressure is set at: _____ mmHg
(Normal suction pressure: 80-120mmHg)

Size of suction catheters to be used is: _____ fr

iii. Tracheal Suctioning

Figure 13. Traditional suctioning through a trach tube. Picture used with permission from CANVent Ottawa

IMPORTANT! Check your suction equipment every day! It must always be ready-for-use.

Tracheal Suctioning

You will need:

- Suction machine – electrical or portable
- Suction tubing
- Sterile Distilled water (flushing solution)
- Clean container for flushing solution
- Disposable suction catheters of correct size
- Clean disposable gloves
- Hand sanitizer
- Manual resuscitation bag with flex hose and trach adapter, if needed
- Extra inner cannula, if needed
- Obturator
- Suction unit plug and charger, if needed
- Plastic bag for disposal of materials

Tracheal Suctioning Procedure

1. Wash hands well
2. Fill the container with sterile distilled water
3. Attach the suction catheter to the connecting tubing of the suction machine
4. Turn on the suction machine and be sure there is good suction
5. Make sure the person you will be suctioning is in comfortable position. Their head should be above their shoulders
6. Put on clean gloves being careful not to touch anything except the catheter

IMPORTANT! Use a clean suction catheter for each suction session.

7. Withdraw the catheter from package slowly. Hold the catheter with your gloved hand 10 to 15 cm (4 to 6 inches) from the tip or the desired suction depth
8. Remove the cork, trach mask, ventilator or manual resuscitator bag from the trach, if needed
9. Gently put the catheter 4 to 5 inches into the trach opening. Stop if there is resistance or if there is a cough. It is normal for someone to cough when they are being suctioned. But not everyone will cough

IMPORTANT! Do not push or force the catheter. Be gentle when advancing the suction catheter.

10. If you hit resistance, pull back slightly
11. You are now ready to apply the suction. Cover the thumb hole on the catheter and slowly take the catheter out while twisting, or 'rolling' it between your fingers. You can pull the catheter straight out or roll it back and forth between your fingers. It all depends on what works best to remove the mucus. It takes practice to find what works best to remove the mucus

IMPORTANT! Do not cover the thumb hole on the catheter until you are ready to suction. Suction only when you are removing the catheter.

IMPORTANT! The suction catheter should not be in the trach for more than 20 seconds.

12. Rinse the catheter out by dipping the catheter tip into sterile distilled water and suction water through the catheter and suction tubing until it is clear. You can use the same catheter to suction a few times, as long as it is kept clean. However, if the catheter becomes blocked with mucus, or touches a dirty surface, remove it and use a new one
13. Ask the patient "Do you need to be suctioned again?" Suctioning is needed if you hear "gurgling" sounds during breathing. Repeat steps 10 to 14, if more suctioning is needed

Note: *Suctioning can cause the client to feel very short of breath. So take breaks between suction attempts. You may need to place the client back on ventilator for a while or give them some manual breaths with the resuscitation bag in between the suctioning sessions.*

14. Look at the mucus being suctioned out. Take note of the amount, the colour, the thickness and the smell
15. When you are finished suctioning, put the cork, trach mask or ventilator back on the trach tube, as before. Be sure to replace the cork/speaking valve and/or the heat and moisture exchanger (HME) after the suction session
16. Coil or wrap the suction catheter around the fingers and palm of one hand, then pull the cuff of the glove over the top of the coiled catheter to completely cover it. Throw out the gloves and dirty catheter. Throw out the suction catheter after each suction session
17. Turn off the suction unit
18. Empty and clean the suction drainage bottles and containers, if needed
19. Wash hands well
20. Be sure the suction equipment and supplies are ready for the next use. You never know when a trach patient needs to be suctioned. Have all your suctioning equipment ready in case you need it quickly [1(33-37),10(7-8)]

iv. Cleaning the Portable Suction Unit

There are many types of suction machines that are on the market. Review your unit's User's Manual for cleaning instructions.

Cleaning Procedure:

1. The connecting tubing should be rinsed thoroughly after every use. This can be done with tap water or normal saline. With the suction machine still on, put the tubing in a container of water. Suction the tap water or normal saline through the tubing until it is cleared of mucus. Rinse with hot tap water and let air dry.
2. Shut off the power to the unit and disconnect the power source
3. Disconnect tubing and remove collection bottle from holder
4. Carefully remove lid and empty contents. The suction collection bottle should be emptied if the mucus and water level are ⅔ full. You can dump the contents into the toilet.

IMPORTANT! To prevent possible risk of infection from contaminated cleaning/disinfection solutions, always prepare fresh solution for each cleaning cycle and discard solution after each use.

5. Wash container, lid and connecting tubing weekly in warm water/dishwashing solution.
6. Rinse with clean, warm water. Soak in 1 part vinegar (≥5% acetic acid concentration) to 3 parts water (131˚F-149ºF or 55˚C-65˚C) solution for one hour.
7. Rinse with clean, warm water
8. Completely air dry, then reassemble

v. Suctioning On The Go

Before going out, make sure the portable suction unit is fully charged and you have all supplies with you.

- Portable suction supplies:
- Suction catheters
- Connecting tubing
- Gloves
- Masks
- Hand sterilizer
- Distilled water,
- Spare inner cannula, if applicable
- Manual resuscitator
- Trach Kit

vi. Other Helpful Tips

You should only use one suction catheter per suction session.
If the catheter becomes clogged, and you are unable to suction water into the tubing, throw it out. Replace with another sterile catheter. Sometimes it is helpful to give a few breaths through a resuscitation bag before and after the session which may help move mucus higher in the airway and help relieve shortness of breath.

vii. Troubleshooting

Why does the client feel so short of breath when they are suctioned?

Suctioning not only removes the mucus in your airways, it also removes some air from your lungs. Having some air suctioned out from your lungs can make you feel short of breath. For this reason, try to keep the suction time to less than 20 seconds and rest between each attempt. You can also use a manual resuscitator bag, before and after suctioning. This often helps you feel less short of breath and may help move the mucus further up the airway so the suction catheter can suction it out.

Why is blood coming up the suction tube?

You may see blood when you suction. This can be normal if there is mucus coming away from the lung wall. This may also happen if the suction catheter is too large for the airway, or if there is too much force when placing the suction catheter into the airway and trach tube. Be sure to always gently advance the suction catheter into the trach tube. Gentle advancement should not cause bleeding.[1(36),10(7-8)]

viii. How Do I Order Parts?

Suction catheters need to be replaced more often than the other suction machine parts. Check with your vendor order more catheters, suction tubing and any other parts of the suction unit that need to be replaced. These supplies are funded through the ADP up to predetermined capped amount.

F. REFERENCES

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10. Ontario Government Assistive Devices Program. Website: https://www.ontario.ca/page/respiratory-equipment-and-supplies Accessed March 10, 2017

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9. EMERGENCY CONTACTS & PLANNING

A. PERSONAL INFORMATION & RECORDS

Fill out the following information and keep it with you. Be sure to keep your personal information and records updated and bring this information with you when leaving home or going to the hospital.

Your Contact Information:

First Name _____
Middle Name: _____
Last (family) Name: _____
Street Address: _____
City: _____
Postal Code: _____
Home Phone: _____
Cell Phone: _____
Email: _____
Date of Birth (dd/mm/yy): _____
Allergies: _____
_____

(Please also list what your reaction symptoms are)

Your Ventilator Settings

These settings are determined by your Doctor and Respiratory Therapist. Do not change these settings without talking to your doctor. You want a complete list of all settings, even those you do not see on the front of the ventilator.

Make: _____
Model: _____
Mode: _____
Volume: _____
Breath Rate: _____
Inspiratory Time:: _____
Low Minute Volume: _____
Pressure: _____

Your Trach Tube

Make: _____
Model: _____
Cuff or Cuffless? _____
Type/Serial #: _____
Size: _____
Ordering information: _____
_____

Record of Trach Tube Changes

Date of Trach Change (D/M/Y)	Trach Tube Make & Model	Tube Size	Tube Type	Location of Trach Change	Who changed the trach tube?

Special Instructions for Trach Tube Changes:

_____
_____
_____
_____
_____
_____

B. YOUR PERSONAL SUPPORT NETWORK

This is a list of people who know about your health care needs and can be called upon to help you in an emergency.

Family Doctor
Name: _____
Phone Number: _____

Other Doctor
Specialty:_____ Name: _____
Phone: _____

Home Healthcare Professional
Specialty:_____
Name: _____
Phone: _____ email: _____

Home Healthcare Professional
Specialty:_____ Name: _____
Phone: _____ email: _____

Equipment Supplier
Name: _____
Phone: _____

Family Member/ Family Friend
Name: _____
Phone: _____

Family Member/ Family Friend
Name: _____
Phone: _____

Other Contact: Specialty: Ventilator Equipment Pool (VEP)
Name: _____
Phone: _____

Other Contact: Specialty: Home Care Company/ CCAC nurse manager
Name: _____
Phone: _____

C. EMERGENCY PREPAREDNESS

It is important to have a plan in case of an emergency. An emergency could be anything from a long term power failure due to a snow storm, ice storm, or something unexpected.

- If you have been provided with a 12 V marine battery as backup from the VEP; ensure it is always charged and ready to be used. Don't wait for an emergency to find it is not ready to use (refer to information that came with the battery and charger)
- Have a plan to go somewhere where there is power and that is located close to your home. Suggestions might be a hospital, fire station, ambulance hall, or hotel. Prepare ahead of time. Perhaps speak with someone at this location, discuss your situation, and make arrangements for emergencies.
- Your power company (Ottawa Hydro or Hydro Ontario) should be made aware that you are dependent on a ventilator for life support. Ask your doctor to supply a letter made out to your power company and ensure your power company gets the letter.
- Call family or friends to see if they have power.
- If you live in a high rise apartment, if power out for a long time, how would you get out? Plan and think through some ideas.
- If you are able to get out of the house or apartment, how will you travel to the location?

ADDRESS of closest family, friend, fire station, or hospital

_____

_____

_____

_____

_____

In an emergency, you will need to leave your home quickly. It is important to have a bag packed, with everything you will need, ready to pick up and go. [1(7-8)]

Things To Include In Your Bag

- ❑ Spare trach tubes - current size and a size smaller
- ❑ List of your ventilator settings
- ❑ List of cough assist settings
- ❑ Spare ventilator circuits and any heat moisture exchangers (HME)
- ❑ List of Medications - inhalers and oxygen
- ❑ Your contact list - healthcare team names and phone numbers
  - ❑ VEP number
  - ❑ Personal support network names and numbers
  - ❑ Equipment supplier name and phone number

- ❑ Resuscitation bag and mask for rescue breathing
- ❑ Portable suction unit and supplies
- ❑ D/C battery and connections and charger
- ❑ Cough assist unit
- ❑ Other items _____

_____

_____

Emergency Supplies

It is suggested by the "Emergency Preparedness Guide for People with Disabilities/Special Needs from Emergency Management Ontario that you should keep one week of supplies available in the event that you must remain in your home.

- ❏ Respiratory travel bag
- ❏ Enough medications
- ❏ medicAlert bracelet or identification
- ❏ Bottled water
- ❏ Food (non-perishable)
- ❏ Manual can opener
- ❏ Flashlight and batteries
- ❏ Spare batteries
- ❏ candles/matches/lighter
- ❏ Important papers (identification)
- ❏ Clothing and footwear
- ❏ Blankets or sleeping bags
- ❏ Hand sanitizer or moist towelettes
- ❏ Radio - hand cranked or battery
- ❏ Toilet paper and other personal items
- ❏ Extra car keys and cash
- ❏ Whistle (to attract attention if needed)
- ❏ Playing cards
- ❏ First aid kit
- ❏ Garbage bags
- ❏ Back pack or duffle bag

Emergency Preparedness Guide For People With Disabilities and Special Needs

Information above can be found at www.emergencymanagementontario.ca or www.getprepared.gc.ca

Fire Precautions

- Fire extinguishers
  - Have 2 in the home
  - Need to be checked once a year
- Smoke/Carbon Monoxide detectors
  - one on every level of your home
  - change the batteries 2 times/years- Many do this when the clocks move ahead in the spring or move back in the fall

D. USEFUL WEB RESOURCES

- Canadian Alternatives in Non Invasive Ventilation
  www.CANVentOttawa.ca
  The online learning modules include instruction and video clips on:
  - Lung Volume Recruitment (LVR Bag)
  - Manually Assisted Cough (MAC)
  - Mechanical Insufflation Exsufflation (MI-E)
  - Glossopharyngeal (GPB)
  - Non Invasive ventilation
  - Mouthpiece ventilation

- West Park Healthcare Centre Long-Term Ventilation Centre of Excellence
  www.ltvcoe.com
  The online learning modules include:
  - Caring for an individual who requires Long Term Ventilation (LTV)
  - Introduction to invasive LTV
  - Tracheostomy Tubes and stoma care
  - Tracheal Suctioning and Manual Ventilation

- Ontario Ventilator Equipment Pool (VEP)
  www.ontvep.ca
  The VEP is a provincial service operated by Kingston General Hospital to provide life enhancing equipment to Ontario residents. It is funded by the Ministry of Health and Long term Care (MOHLTC) and provides this equipment to those that qualify through the Assistive Device Program.
  - Provides equipment and 24 hour technical support
  - Provides manuals, videos, and FAQs for all equipment provided

- A web guide to using Non-Invasive Ventilation
  www.niv.mymnd.org.uk
  Information and videos on noninvasive mask ventilation

Useful Resources for Specific Conditions:

- The ALS Society of Canada
  www.als.ca

- Muscular Dystrophy of Canada
  www.muscle.ca

- Post Polio network
  www.post-polio.org

- Spinal Muscular Atrophy
  www.smafoundation.org

- The Lung Association of Canada
  www.lung.ca

- March of Dimes Canada
  www.marchofdimes.ca/dimes

Ventilator User's Network

- International Network for Users of Ventilators
  http://www.ventusers.org/ -

Government Program

- Assistive Devices Program
  www.ontario.ca/page/assistive-devices-program

E. REFERENCES

1. Bayliss M, Hamp C, Johnson D, et al. Ontario, Canada. June 2010. Optimizing Respiratory Therapy Services. A Continuum of Care from Hospital to Home. Patient/Clients and Caregivers

10. CAREGIVER'S ASSESSMENT

A THE IMPORTANCE OF THE CAREGIVER'S ASSESSMENT

- It is important to be able to recognize if your client is struggling to breathe. It can be a matter of life and death.

- Sometimes the client is able to tell us they are having trouble breathing, and other times they are not able to tell what is wrong and how to help them. In these times, you should be able to recognize that there is a problem and be able to respond appropriately.

In this **Section**, we will discuss ways of identifying if your client is in respiratory distress and how to react initially. This **Section** does not describe how to treat the client beyond the first few moments.

B. RECOGNIZING THERE IS A PROBLEM

- To recognize a problem, you must know your surroundings at baseline. This includes what the client's breathing looks and sounds like normally, noises in the home, breathing machine alarm sounds, the client's ways for showing he/she needs help, normal vital signs and normal sleeping habits or level of consciousness of the client, etc.

- When you sense a problem or hear alarms, first look at the client before going to assess the alarming breathing machine or any monitors. It can be tempting to run past the client and go directly to an alarming machine to see what all the alarming is about. However, sometimes the problem is with the client and you are wasting precious time with the machine.

- Generally, when someone is having trouble breathing, they will show signs that they are working harder to breathe. They may try different ways to tell you that they are having trouble breathing and need help. If they aren't able to tell you, you will have to recognize the signs and symptoms of breathing distress which are discussed in **Section 10:E**.

C. CLIENT COMMUNICATION DURING BREATHING DIFFICULTIES

- Sometimes, a client that tells you what is wrong. Not all clients are able to do so.
- Some clients already have a method of communicating when/if they cannot speak. For example:
  - Clicking of their tongue
  - Making unusual sounds
  - Trigger the emergency bell, or ventilator alarm
- Other times, people get so short of breath they cannot communicate at all suddenly or they are not able to communicate even at baseline. Your assessment skills are especially important during these times.

D. RESPIRATORY FAILURE

- Once respiratory failure begins, the respiratory muscles try to work harder. This makes the muscles even more tired.
- It is easier to recognize respiratory failure when the breathing muscles start working hard to breathe.
- It is difficult to recognize respiratory failure when the breathing muscles are so tired that they slow down.
- It is also difficult to recognize respiratory failure when a client doesn't have properly functioning breathing muscles to begin with. Your assessment skills are especially important during these times as well.
- If respiratory failure is not recognized during early or late phases, then it will lead to death.

E. IF THE CLIENT IS HAVING TROUBLE BREATHING, YOU MAY NOTICE SOME OF THE FOLLOWING SIGNS AND SYMPTOMS:

- Breathing faster (e.g. over 30BPM)
- Breathing very slowly (e.g. less than 8BPM)
- A strange or abnormal pattern of breathing
- Short of breath at rest
- Skin colour changes to a gray or pale colour
- A gray-blue colour around the mouth, inside of the lips or fingernails
- Face looks scared
- Sleeping more often
- Having difficulty sleeping and/or waking
- Can't lie down because it causes too much shortness of breath
- Very tired
- Confusion
- Clammy skin or sweating
- Can't concentrate
- Periodic or constant headache
- Unconsciousness and can't rouse
- Rising or dropping heart rate
- Ventilator is alarming

F. WHAT DO I DO IF THE CLIENT IS IN BREATHING DISTRESS?

1. Do a **quick scan with your eyes** of the situation. The scan should be done in a matter of **seconds** so as not to waste time helping the client.
Quickly glance first from client's face and body, to client's airway, to the equipment (if client is on a machine) starting at the client and going to the machine.

- Quickly scan the client's face and body
    - When you are looking at the client, you are assessing for signs of breathing difficulties and anything abnormal.
    - For example, coughing or choking, change in consciousness, or strange breathing patterns.

- Then quickly scan the client's airway
  - When you glance at the airway (normal airway or tracheotomy) you are looking to see if it is open and clear.
  - For example, has the trach fallen out? Is the cuff up or cork on when it shouldn't be? Has the trach moved and maybe it is blocked. Has the client vomited and is choking on vomit?

- Then quickly glance at the equipment, from the interface, circuit to the client. When you glance from the airway to the breathing machine, you are looking for problems with the equipment.
  - For example, is the circuit blocked with water or sputum? Is the circuit disconnected? Is there a power failure or vent in-op?

IMPORTANT! In this scan, you are looking for quick clues and obvious problems. You are not expected to find and solve the problem in the first scan.

2. Manually ventilate the client right away, if needed.

   - Keep assessing the situation and complete a repeat scan with your eyes, as you ventilate with the bag. Is manual ventilation working? For example, is the airway clear? Is a suction required?

IMPORTANT! Always make sure Passy Muir Valve is OFF before manual ventilation.

IMPORTANT! Do not waste time trying to solve the problem while the client is struggling to breathe. You should immediately begin helping the client and figure out what happened as you are manually ventilating and calling for help. Help their breathing with a manual resuscitator bag. Continue looking for the problem and calling for help while manually ventilating.

3. Call out for help or call 911
4. Stay with the client and tell them what is happening and that help is coming
5. Continue manually ventilating as needed
6. Once emergency help/support has arrived tell them what happened

G. REFERENCES

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11. CLIENT TRANSITIONS

A. HOSPITAL TO HOME

Preparing for discharge home from the hospital can be a busy and stressful time. Families and caregivers may feel excited, anxious and maybe even fearful. Being able to return home is often considered a blessing but the transition requires lots of preparation and learning experiences. Transitioning home successfully requires planning and getting access to adequate and appropriate education with the opportunities to develop your skills.[1] Ideally, you, your family and caregivers leave the hospital feeling confident in the knowledge and skills you acquired to manage and participate in daily life. Resources to troubleshoot and respond to medical changes or emergencies that may arise should be readily accessible to you and caregivers. Part of planning for home will include acquiring your home respiratory care equipment and supplies.

Home Respiratory Care Equipment and Supplies

Respiratory care equipment used at home will be provided by two sources:

1. Ventilator Equipment Pool (VEP)
2. Home Care Vendor or Service Company

What Is The Ventilator Equipment Pool?

The VEP is a provincial service operated by Kingston General Hospital to provide life enhancing equipment to Ontario residents. It is funded by the Ministry of Health and Long term Care (MOHLTC) and provides this equipment to those that qualify through the Assistive Device Program.

- Provides equipment and 24 hour technical support
- Provides manuals, videos, and FAQs for all equipment provided

The VEP is a provincial equipment pool that manages ventilators and a list of other respiratory equipment for clients in Ontario.[2]

Your Respiratory Therapist will work with the VEP to choose the best type of ventilator, circuit, humidity system and power supply for each client.

Once the equipment arrives at the hospital it will be dispensed and you will have a trial with the equipment before discharge home. In addition to education and training provided in hospital, the VEP offers one visit from a Respiratory Therapist who will review the equipment and any technical concerns about therapy.

What Equipment is Available from the VEP?

- Ventilator(s)
- Bilevel Positive Airway Pressure Devices with a Set Respiratory Rate
- Heated Humidifier
- Battery Charger
- Re-usable ventilator circuits (breathing tubes)
- Disposable ventilator circuits for mouthpiece ventilation
- External Battery for Emergency Power Only
- Battery Cable
- Cough Assist Device
- Oxygen Saturation Monitor (clients < 19 years of age)

What About other Respiratory Care Equipment and Supplies?

Local home care vendors can provide the following:[4]

- Apnea Cardiorespiratory Monitors
- Compressors for Aerosolized Medication Delivery
- Postural Drainage Boards
- Suction Machines (tubing, catheters and yaunkaurs as well)
- Tracheostomy Supplies
- Percussors
- Manual Resuscitator Bags
- Bilevel Positive Airway Pressure Systems without a Set Rate
- CPAP Positive Airway Pressure Systems
- Auto Positive Airway Pressure Systems
- Masks for Non-Invasive Ventilation or Positive Airway Pressure Therapy
- Ventilator Batteries (Power supply) for Mobility

Equipment highlighted in BLUE are often also required for ventilator assisted clients.

Respiratory Education

For clients on home mechanical ventilation, their respiratory care providers require knowledge, skills and competency. A successful transition home from hospital requires a transfer of care from the hospital care providers to the client, their family and community care providers.[1] This works best when the education and training is provided in the hospital so the client, their family and community care providers feel confident and prepared.

To accomplish this, the respiratory care education sessions should cover the following:[1]

- Respiratory Anatomy
- Tracheostomy Care
- Tracheal Suctioning
- Ventilator Care, Troubleshooting and Maintenance
- Use of Manual Resuscitator Bag
- Power Supply Options
- Cleaning of Equipment

- Lung Volume Recruitment Exercises
- Airway Clearance Techniques
- Chest Action Plan/Decision Tree
- Emergency Plan

Each of these topics should be reviewed in general and in detail as they apply to the client. Caregivers should have the opportunity to receive demonstrations and practice required skills in the hospital before going home with client.[1]

B. HOME TO SCHOOL OR WORK

It is possible to be dependent on medical technology and still attend school or work. You and your care providers can work with their local Community Care Access Centre (CCAC) to support this transition.[5] You may decide how you use the nursing/health care worker's hours you have been funded for and reorganize caregiver schedules to accommodate your needs outside of the home. Social Workers and Occupational Therapists will help you identify the supports available and work with your medical team to determine a plan for these transitions.

C. HOME TO HOSPITAL

Clients at home on long term mechanical ventilation require careful monitoring and follow up with their medical team. There will be regular clinic visits at the Doctor's office and the hospital with various services to follow up and manage your medical care.

Readmission may be needed for elective procedures and/or emergency care. Be sure to be prepared with the appropriate equipment, up to date medication lists, current respiratory care plan and your emergency contact lists (See **Section 9: Emergency Contacts & Planning**).[1]

D. END OF LIFE CARE

The goal of care at the end of life is comfort and the enhancement of quality of life and relationships.

Accepting, changing or refusing assisted mechanical ventilation in the home is a decision that only you and your family can make. There are no good or bad decisions. You may change your mind at any time if you decide that the current care plan is no longer in your best interest.

New symptoms may evolve over time and require assessment and treatment by experts in symptom management. The Palliative Care Team is a team that focuses on treating symptoms and trying to relieve the stress of living with a life-limiting illness. Their focus is to build a trusting, working relationship with you, to treat your symptoms, and to improve the quality of your life. The Palliative Care team will be an "added care" and will work with your respiratory care team or any other team you are involved with to support you.[7] You can ask your Doctor to be referred to this team.

The best decisions are usually the most informed ones. It is important to start thinking about you and your family's end-of-life wishes before decisions need to be made in an emergency situation. Your end-of-life decisions are primarily yours to make but you should inform your loved ones of your wishes and have a discussion with them about it. Make an effort to get to know what your options are. There are different care goals available and it is your choice how

much you want to be treated, how invasively, or non-invasively, and for how long. There is support available for whatever your care goals are. Ask your Doctor about your options.

Sometimes after medical conditions change or there is worsening of disease, people change their mind and treatment choices. It is ok to change your mind. Just be sure to tell your loved ones and document your wishes with a living will or advanced directive. Living wills and advanced directives help guide the medical team when caring for you and in emergency situations.[6]

Regardless of the decisions that you make, your team will continue to support you and ensure that you are properly cared for and comfortable.

E. REFERENCES

1. Bayliss H, Hamp C, Johnson D, et al Ontario, Canada. June 2010. Optimizing Respiratory Therapy Services. A Continuum of Care from Hospital to Home. Patient/Clients and Caregivers

2. Ontario Ventilator Equipment Pool Website Copyright 2014 www.ontvep.ca Accessed April 2017

3. Ontario Ventilator Equipment Pool Website www.ontvep.ca/w/wp-content/uploads/2014/05/Application-and-adendum.pdf Accessed April 2017

4. Government of Ontario Website Published December 2016, Updated January 2017 www.ontario.ca/page/respiratory-equipment-and-supplies Accessed April 2017

5. Champlain Community Care Access Centre Website Copyright 2016 www.healthcareathome.ca/champlain/en Accessed April 2017

6. National Program for Home Ventilatory Assistance Patient Information Booklet. McGill University Health Centre. Revised March 2016

7. Champlain Community Care Access Centre Website Copyright 2016 www.champlainpalliative.ca/en/ Accessed April 2017

12. FUNDING

A VENTILATOR EQUIPMENT POOL

Equipment provided by the Ventilator Equipment Pool is 100% funded by the Ministry of Health and Long Term Care (MOHLTC), through the Assistive Devices Program (ADP).[1,2,4]

Applications for this equipment will be made once long term ventilation has been prescribed during admission to hospital.[1] The application must be signed by the Doctor.

The list of equipment provided by the VEP includes:

- Ventilator(s)
- Bilevel Positive Airway Pressure Devices with a Set Respiratory Rate
- Heated Humidifier
- Battery Charger
- Re-usable ventilator circuits
- External Battery for Emergency Power Only
- Battery Cable
- Cough Assist Device
- Oxygen Saturation Monitor (clients < 19 years of age)

This equipment is provided as long as it is determined that the client requires it. It does not belong to the client however, and should the equipment no longer be needed, it must be returned to the VEP. It is considered a long term loan.

Contact the VEP for more information on acquiring equipment. Note: some clients do not qualify for VEP equipment. For example, clients discharged from hospital to a long-term care facility will not qualify for VEP equipment.

B. EQUIPMENT PROVIDED BY HOME CARE VENDORS

This includes but is not limited to:

- Apnea Cardiorespiratory Monitors
- Compressors for Aerosolized Medication Delivery
- Postural Drainage Boards
- Suction Machines (tubing, catheters and yankauers)
- Tracheostomy Supplies
- Percussors
- Manual Resuscitator Bags
- Bilevel Positive Airway Pressure Systems without a Set Rate
- CPAP Positive Airway Pressure Systems
- Auto Positive Airway Pressure Systems
- Masks for Non-Invasive Ventilation or Positive Airway Pressure Therapy
- Ventilator Batteries (Power supply) for Mobility

The Assistive Devices Program funding covers 75% of the cost of this equipment up to a capped amount.[1,4]

Please be sure to work with your vendor to verify exact funding amounts. For example:

1. Funding will be approved by ADP for one suction unit only.[4] Client may need a portable suction unit and a stationary bedside unit.

2. The funding provided by the ADP has a capped amount.[4] This may determine the brand or type of suction unit you choose to purchase.

IMPORTANT! The responsibility falls on the client and or family to research the best and most affordable options.[3]

C. WHAT ABOUT THE REMAINING 25% COST?

The remaining 25% is the responsibility of the client or parents. Private insurance plans may cover these expenses. A medical prescription and letter of medical necessity may be required for submission. Contact your prescribing physician for any letter of support required. Again, be aware that there may be a fee for this service.

D. WHAT ABOUT MASKS FOR POSITIVE AIRWAY PRESSURE THERAPY?

There are more and more masks available to provide the best comfort, fit and therapeutic effect.

IMPORTANT! Always be sure to have your mask fit at pressure with the therapy you have been prescribed.

If the mask is needed for non-invasive ventilation and the ventilator or Bilevel device is provided by the VEP (and 100% funded), the client will receive quarterly payments in the amount of approximately $100 each (as of March 2017, verified with ADP) to help cover the cost of masks.

If the mask is to be worn with positive airway pressure therapy (CPAP and Bilevel without a set backup rate, Auto Modes) then the first mask is considered as part of therapy initiation and 75% of cost will be funded up to a capped level.[3] Be sure to verify that amount with your vendor. Masks generally need to be replaced every six months depending on hours of use, care and weight loss or weight gain.

For further funding resources please contact your Social Worker who can provide you with a complete list of government programs and charitable societies that you may tap into.

E. REFERENCES

1. Bayliss H, Hamp C, Johnson D, et al Ontario, Canada. June 2010. Optimizing Respiratory Therapy Services. A Continuum of Care from Hospital to Home. Patient/Clients and Caregivers

2. Ventilator Equipment Pool Website Copyright 2014 www.ontvep.ca Accessed April 2017

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4. Government of Ontario Website Published December 2016, updated Janaury 2017 www.ontario.ca/page/respiratory-equipment-and-supplies Accessed April 2017

GLOSSARY OF TERMS

The following is a list of words that you may come across in this manual. Some of the terms are things you may hear your healthcare worker say. You can look up words here to learn what the word means. Always ask your healthcare provider if you do not understand something. Never feel too shy to ask.

A

A/C: Alternating current
ADP: Assistive Devices Program
Aerosol: Solution that is given in a mist
Apnea: Not breathing
Antibiotics: Medicines that fight infections
Artificial nose: A device that warms and moistens the air
Artificial airway: A cut made in the trachea resulting in an opening that bypasses the nose and mouth. Also called "trach" or "tracheostomy"
Aspiration: Food or liquid breathed into the airway instead of swallowed
Asthma: Difficult breathing with wheezing that is caused by swelling or spasms of the airways

B

Bacteria: Germs
Bacterial: Caused by bacteria
BiPAP: Bilevel Positive Airway Pressure
bpm: beats per minute (heartbeat)
BPM: breaths per minute (respiratory rate)
Breathing bag: Ventilating bag used for manual resuscitation
Bronchi: The two main branches leading from the trachea to the lungs
Bronchiole: Smaller airways that branch out in lungs and deliver air to tiny air sacs in the lungs

C

Cap: A small cap used to plug the trach opening Cannula: The tube part of the trach tube
Carbon Dioxide (CO_2): Gas eliminated from the lungs with exhalation
Cardiopulmonary resuscitation (CPR): Artificially supporting breathing and the circulation
Carina: The point of where the right and left bronchi separate
Catheter: A small tube placed inside the body to add or remove liquids
COPD: Chronic Obstructive Pulmonary Disease
CPAP: A ventilation mode that helps a patient's own breathing efforts. Stands for continuous positive airway pressure
Cork: A small cap used to plug the trach opening. Cuff: The inflatable balloon on some trach tubes
Cyanosis: A bluish color of the skin due to reduced oxygen in the blood

D

D/C: direct current
Decannulation: Removal of the trach tube
Diaphragm: The big muscle below the lungs that controls breathing
Dysphagia: Difficulty swallowing
Dyspnea: Labored or difficulty breathing, shortness of breath

E

Edema: Swelling of tissue
Encrustation: Hard and dried mucus that can build up around the inner cannula.
ENT: It is a term used for type of doctor that specializes in the 'ear nose throat'. ENT doctors do tracheotomy surgery
ET tube (endotracheal tube): A tube used to provide an airway through the mouth or nose into the trachea.
EPAP: expiratory positive airway pressure
Epiglottis: "Trap door". A piece of cartilage that hangs over the larynx like a lid and stops food,and liquids from going down into the lungs
Esophagus: The tube between the throat and the stomach Exhale: To breathe out
Extubation: Removal of the endotracheal tube
Expiration: Breathing out air from lungs

F

Fenestrated: Having an opening in the trach tube to allow speech
Fenestrated inner cannula: An inner cannula with holes in it. This lets air go from the trach tube up to the mouth, and nose. The outer cannula must also have holes in it to work
Fenestration: A single hole or pattern of smaller holes
FiO_2: fraction of inspired oxygen
Flange: Part of the trach tube, also called the neck plate

G

Glottis: The sound producing part of the larynx that consists of the vocal cords

H

HME (Heat Moisture Exchanger): A filter device that fits into the end of the trach tube to warm and moisten the air the patient breathes
Home healthcare professional: Individual who gives care at home
Home healthcare supplier: Also called medical equipment supplier. They provide equipment, oxygen, trach care supplies.
HR: heart rate
Humidity: Moisture in the air
Hydrogen peroxide (H_2O_2): Mild cleaning agent
Hypoventilation: Reduced rate and depth of breathing
Hypoxemia: A low amount of oxygen in the blood

I

Inflation line: The thin plastic line attached to trach tube balloon on one end and pilot balloon on the other. It is used to inflate and deflate the trach tube balloon (cuff).
Inflation syringe: A plastic syringe without needle used to inflate the trach tube balloon (cuff)
Inhale: To breathe in.
Inner cannula: The inner removable tube that fits inside the outer cannula. May be removed to clean or exchanged with different inner cannula.
Inspiration: To breathe in
Intubation: Placement of a tube into the trachea to help with breathing.
IPAP: inspiratory positive airway pressure

K

Kyphoscoliosis: curvature of the spine

L

Larynx: "Voice box" which is just on top of the trachea.
LED: Light Emitting Diode
LHIN: Local Health Integrated Health Network
Lumen: The inside of the trach tube through which air passes
LVR Lung Volume Recruitment: A technique to add more air to your lungs beyond what you can do by yourself

M

MAC(Manually Assisted Cough): technique using strong arms to assist your cough
MDI: metered dose inhaler.
MI-E: mechanical insufflator-exsufflator
MOH: Ministry of Health
MPV: Mouthpiece ventilation
Mucus: Slippery fluid that is made in the lungs and windpipe
mm: Short form for millimeter. One millimeter equals .039 inches

N

Nebulizer: A machine that puts moisture and or medicine into the airway and lungs
Neck plate: Part of the trach tube that sits against the neck, also called the flange
Non-invasive: does not puncture the skin or enter a body cavity
Nosocomial infection: An infection that you got during your hospital stay

O

Obstruction: Blockage
Obturator: The guide that goes in the trach tube to help insert the tube into the trachea
Outer cannula: The main tube with neck plate that is placed into the trachea
Oximeter: Equipment that monitors the amount of oxygen in the blood
Oxygen: O_2, A gas that the body needs to stay alive

P

Partial Support: person is able to breathe on their own in between the breaths delivered by the ventilator. The ventilator does not have to deliver the full breath, if the person has some breathing effort of their own.
Patent: Open, clear airway
PEEP: Positive end expiratory Pressure
PIP: peak inspiratory pressure
Pneumonia: Swelling of the lung that is often caused by germs

Q

R

Respirologist: A doctor who looks after the lungs
Respite: A break for caregivers who care for a disabled family member at home
Retractions: Pulling or jerky movement of the chest and neck muscles. It's a sign of respiratory distress
RR (Respiratory rate): the number of breaths taken in one minute

S

Secretions: Another word for mucus
SD card: secure digital
Speaking valve: A one way valve that lets air come into the trach tube when you breathe in. When you breathe out, the valve closes sending air out past the vocal cords and through the mouth so speech is possible.
Speech language pathologist: A person trained to help with speaking and swallowing problems
Stoma: The hole in the neck where you insert the trach tube
Sterile: Very clean and free from germs
Suctioning: One way to keep the inside of the trach tube clean and free of mucus. A small catheter is connected to a suction machine and placed into the trach tube to remove mucus.
Swivel neck plate: A neck plate that can swivel up and down and/or side to side. Allows for greater range of head and neck movement without discomfort.
Syringe: Device to measure medicine or use for equipment

T

Total Support: people who need the ventilator to do all their breathing would be on total support. A trach tube is often used for those who need the ventilator to do all their breathing. People on 'total support' are not able to use a mask.
Trach: Usually refers to the tracheotomy tube. The word 'trach' sometimes also refers to the tracheotomy surgery.
Trach mask: A device that fits on the end of the trach tube to provide moisture
Trachea: "Windpipe". The tube through which air flows between the larynx and the lungs
Tracheal wall: The inside lining of the trachea
Trach Tube: A tubular device placed into the trach
Trach Ties: Cotton twill or Velcro tapes used to hold the trach tube in place. Connects to the slots in the trach tube neck plate

U

V

Ventilator: A machine that helps a person breathe
VEP: Ventilator Equipment Pool
Virus: A germ that can cause illness
Viscous: Thick or sticky
Vocal cords: Two strips of tissue in the voice box in the neck, which allows vocalization
VT(Tidal Volume): the size of your breath when your breathe in and out at rest

W

Wheeze: A whistling sound coming from the lungs because of a narrowing in the windpipe or airways.

X

Y

Z