SOMERSET WEST
COMMUNITY
HEALTH
CENTRE

CAREGIVER'S GUIDE TO RESPIRATORY CARE IN THE HOME

PAEDIATRIC

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 paediatric 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.

ACKNOWLEDGEMENTS

The Somerset West Community Health Centre acknowledges the Champlain Local Health Integration Network for funding this collaborative initiative entitled A Caregiver's Guide to Home Respiratory Care.

We acknowledge the following Respiratory Therapists for their dedication to this project.

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Melissa Heletea-McLean BA,BSc,RRT
Michelle Maynard BSc,RRT,CRE
Kathy Walker BSc, RRT,CRE

We would also like to acknowledge the following organizations for their assistance with this project.

Children's Hospital of Eastern Ontario
College of Respiratory Therapists of Ontario
Ontario Ventilator Equipment Pool
Provincial Respiratory Outreach Program of British Columbia
Regina Qu'Appelle Health Region
The Ottawa Hospital CANVent Program
Ventilator Equipment Pool

We would also like to acknowledge the families that have given their permission in the production of this caregiver manual.

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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7. OTHER EQUIPMENT AND THERAPIES

1. PEDIATRIC AIRWAY AND BREATHING

A THE NORMAL RESPIRATORY SYSTEM

The respiratory system carries air in 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. When air leaves the lungs during exhalation it 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 central nervous system function may not breath as often or as deeply as they need to for the body to stay healthy

Pediatric Airway and Lung Anatomy

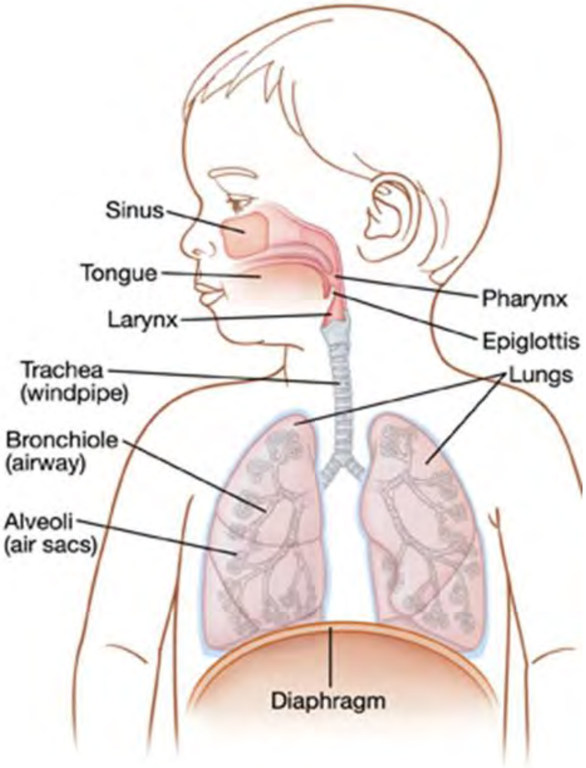


Figure 1 Pediatric Airway and Lungs Anatomy
www.fairview.org

Children Are Not Small Adults

The pediatric airway and breathing system is made up of the same parts that an adult's respiratory system is. However, it is important to understand the differences between the two systems to have a good understanding of how children breath normally and what you may see when they are having difficulty breathing.

Upper Airway Anatomy and Function

Air passes through the nose and is filtered, warmed and humidified as it travels through the nasal passages through the upper airway. When we breathe through our mouth, it does not do a very good job of filtering or humidifying the air before it reaches the lungs. Mouth breathing usually happens in children and adults when their nose is congested or blocked. The mouth is the passageway for food and air.

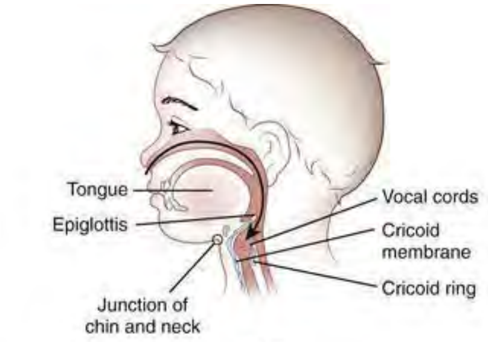
Newborns and babies prefer to breathe through their nose during the first 3-6 months of life.[2]

This means that babies can really struggle during colds when their nasal passages are blocked with mucus.

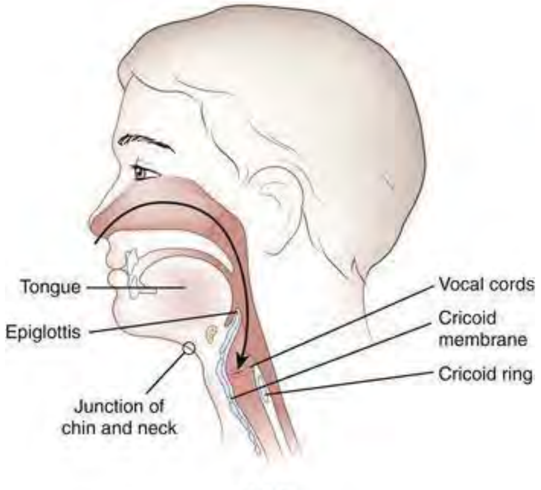
Even the common cold virus can lead to hospitalization in the first few months of life. Nasal stuffiness or congestion, and that fact that babies cannot blow their nose will make breathing and feeding difficult.[3]

The **pharynx** is the cavity at the back of the mouth and base of the tongue. In children, the tongue takes up most of the space in the mouth. This means that the space in the airway at the back of the throat is smaller and at higher risk of being blocked by the tongue.[2]

The **epiglottis** covers the larynx (voice box) during swallowing. This prevents food and liquids from entering the trachea (windpipe) and getting into the lungs.



Infant



Adult

Figure 2 Anatomic Airway Differences Between Infant and Child
Manual of Emergency Airway Management www.clinicalgate.com

The Lower Airway Anatomy and Function

The larynx is the dividing line or "doorway" between the upper and lower airway. 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 flows 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.

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

The trachea or windpipe is the tube leading from the voice box to the lungs.

Children have a trachea that is smaller, shorter, and funnel shaped when compared to an adult's.

A child's trachea is also floppier or less rigid that an adult's. All of these differences mean that a child's airway is easier to block (obstruct) than an adult's.

The trachea divides into two main branches or bronchi which direct airflow into the left and right lungs. The left 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]

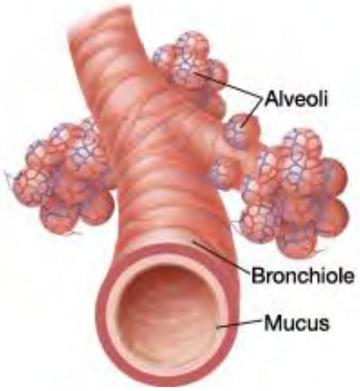


Figure 3 Terminal Airway Anatomy
Fairview Health Services www.fairview.org

Gas exchange happens between the alveoli and the blood vessels surrounding them. Oxygen passes into the blood vessels that surround the air sacs. The blood then carries the oxygen to all parts of 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 a breath IN is just as important as its need to remove Carbon Dioxide when breathing OUT.

The process of gas exchange is supported by adequate VENTILATION.

Ventilation refers to the movement of air into and out of the lungs.

2. What Happens When I Breath?

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 IN. As we breath OUT, the diaphragm relaxes and moves back up.[5]

Chest Wall

Chest wall movements allow for airflow in and out of the lungs. 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.

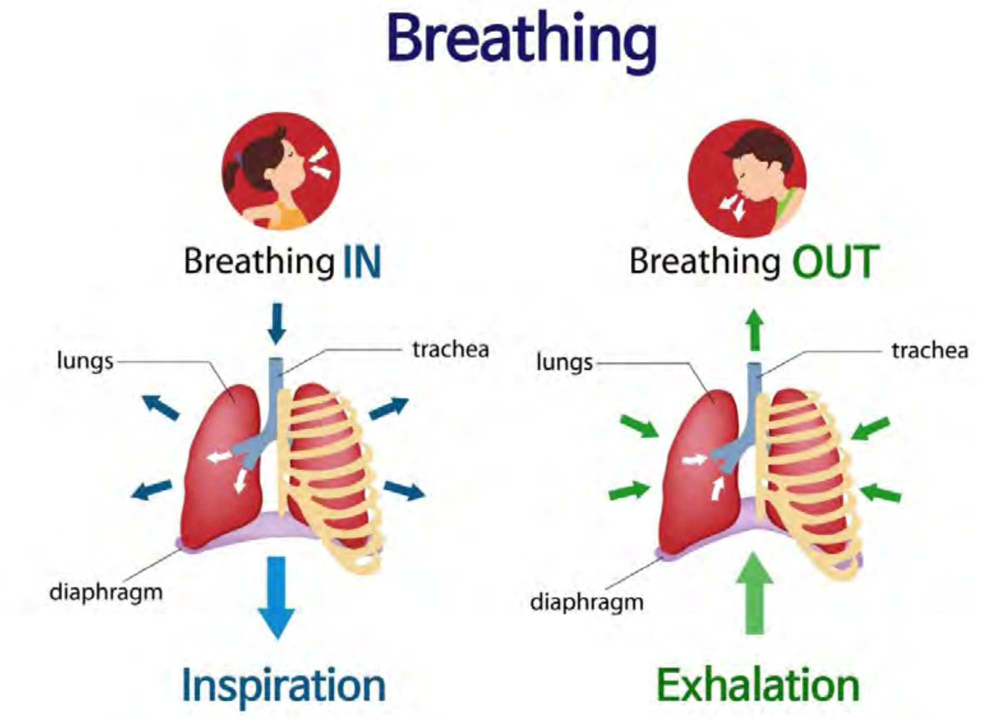


Figure 4 Breathing
Jakinnboaz shutterstock_420501241

Chest wall movement is different in babies and children.

In children, the ribs lie flatter and the rib cage is more cylindrical.[6] This means that the chest cannot increase in size as much as an adult's. An adult's chest wall expands upwards and outward with movement of the ribs. Because babies and small children cannot increase the volume of air taken in during a deep breath like an adult can, they will breathe faster when in distress.

Children rely mostly on movement of the diaphragm to increase the number of breaths they take in per minute and will tire out faster than an adult.

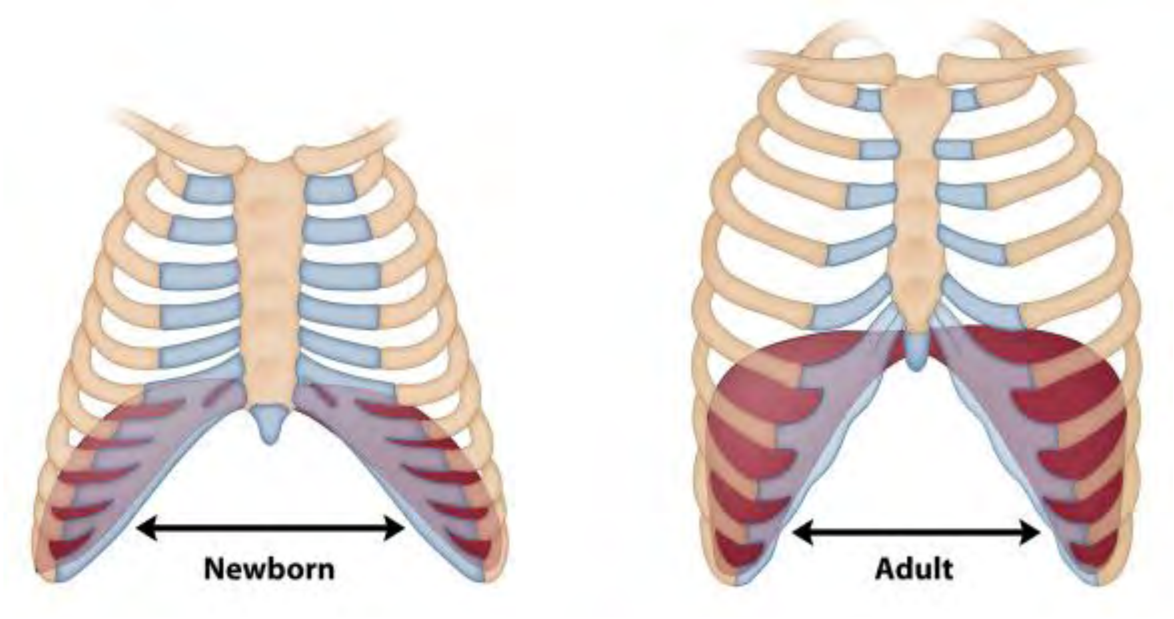


Figure 4 Developmental Changes of the Rib Cage from Birth to Adult
From www.basicsofpediatricanesthesia.com

Babies and children cannot increase the amount of air they take in with each breath. This means that they will work hard to breath faster when they are in respiratory distress.

3. PEDIATRIC AIRWAY DIFFERENCES

In summary, babies and children will tend to have an

- Increased risk of airway obstruction due to the size and shape of their airway. Along with that, young babies prefer to breathe through their nose. Excess mucus in their upper airway can result in significant respiratory distress.
- Increased risk of aspiration into the lungs again due to the size and shape of their airway. Saliva, food, and fluids can then easily be inhaled into their lower airway and lungs. This may lead to serious lung infections.
- Increased risk of ventilatory fatigue or failure because babies and children rely on breathing faster when in distress. This will easily exhaust or tire a child sooner than an adult.

4. BASELINE VITAL SIGNS

It is important to recognize abnormal heart rate, breathing rate and temperature in your baby or young child. We will discuss this further in **Section 11. Caregiver's Assessment**.

Pediatric Vital Signs

These charts are for reference only[7]. It is very important that you are familiar with your child's baseline heart rate, respiratory rate and temperature. Things that are out of your child's normal range will cue you to assess and decide if you need to take action and treat and or seek medical support.

Heart Rate (Beats per Minute)		
Age	**Awake Rate**	**Sleeping Rate**
Neonate (<28 days)	100-205	90-160
Infant (1mo - 1 yr)	100-190	90-160
Toddler (1-2 yr)	98-140	80-120
Preschool (3-5 yr)	80-120	65-100
School-age (6-11 yr)	75-118	58-90
Adolescent (12-15 yr)	65-100	50-90

Respiratory Rate (Breaths per MInute)	
Age	**Normal Respiratory Rate**
Infants < 1 yr	30-53
Toddler (1-2 yr)	22-37
Preschool (3-5 yr)	20-28
School-age (6-11 yr)	18-25
Adolescent (12-15 yr)	12-20

Temperature

Small children lose heat much more quickly that older children and adults and use more energy to generate body heat. Loss of body heat puts stress on vital organs in the body.
Normal body temperature ranges do not vary with age. Try to use the same method each time you measure your child's temperature so that you have a reliable trend.

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 Child’s Normal Vital Signs :

Heart Rate: ________________________________ bpm

Respiratory Rate: ____________________________ BPM

Temperature: ________________________________ °C

D. PREVENTING INFECTION

i. What can I do to Prevent Infections?

Figure 5 Hand Washing
Balkonsky Shutterstock Image 17702794

The Centers for Disease Control and Prevention cite handwashing as the "single most effective way to prevent the transmission of disease."[8]

Be sure to wash everyone's hands often and have hand sanitizer in convenient easily accessible areas around your home and within reach of your child as much as possible.[8] See **Section E** below for complete steps for good handwashing technique.

Figure 6 Hand Sanitizer
Marina Lohrback Shutterstock 162745193

Other important steps to 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 flu
- Any visitors with cold or flu symptoms who need to be near your child MUST wear a mask and wash their hands often
- Follow cleaning instructions for tracheostomy tubes, masks and all other respiratory care equipment

Daily application of these basic measures will work to prevent infection and support a better quality of life for you child!

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 air flow to travel in and out of the lungs.[1] Children using assisted ventilation are more susceptible to lung infections[9]. It is very important to recognize your child's signals or symptoms and follow your respiratory care plan and seek medical support as soon as they occur.

iii. What are the signs of a Lung Infection?[1]

- Increased cough
- Fever
- Child complains of or you suspect is feeling unwell and very tired
- Child seems more short of breath
- Complaining 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 your child has a tracheostomy, the stoma may look red and swollen or even seem painful

iv. What Should I do If I Suspect a Lung Infection?

If you suspect a lung infection call your health care 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[1]. Refer to **Section 10. Emergency Contacts and Planning**. You may also try to:

- Have your child rest more
- Be sure your child gets plenty of fluids (by mouth or G-tube) unless fluids are medically restricted
- Have your child use their breathing machine for longer periods of time, even during the day (if applicable)[9]

If prescribed an antibiotic, be sure your child takes the full course of medication even if symptoms go away.

v. Washing your Hands at Home

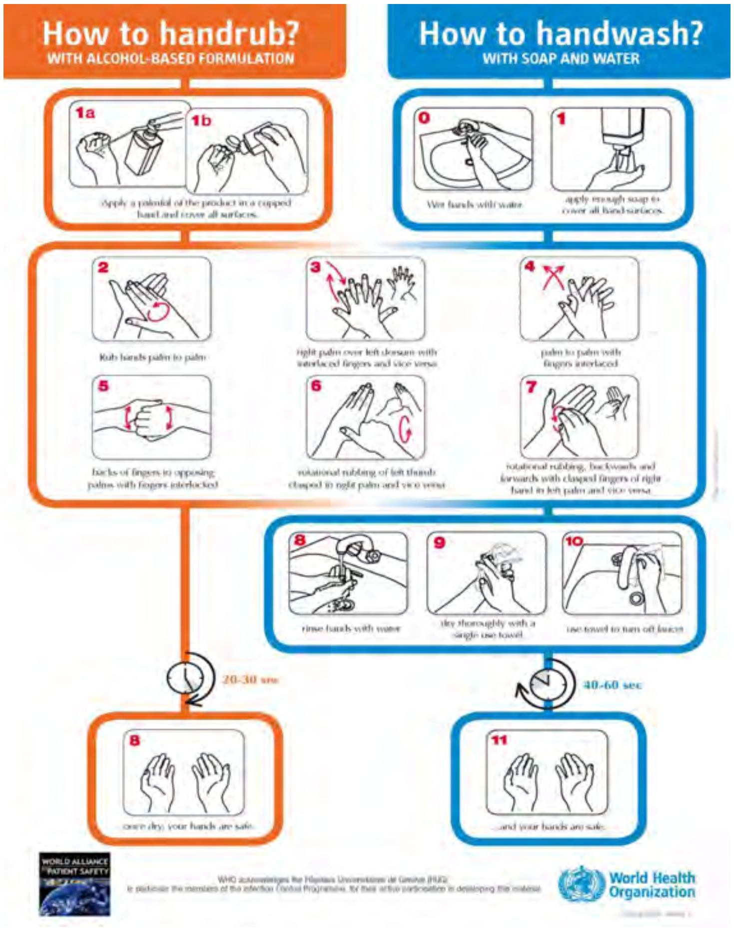


Figure 8 Hand Washing
Reproduced with Permission from the World Health Organization
Accessed on April 9,2017 from http://www.who.int/gpsc/tools/GPSC-HandRub-Wash.pdf

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 child's 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 drug store or grocery store.

Use only distilled water that has been sterilized. This will kill harmful germs and bacteria that can cause lung infections[10]

How do I make sterile distilled water at home[11]?

- 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[12].
- Turn of 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.

To sterilize your container:

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

G. REFERENCES

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2. TRACHEOSTOMY TUBES

A. WHAT IS A TRACHEOTOMY?

A **tracheotomy** is a hole made in the windpipe, or trachea, just below the vocal cords. The hole is called a **stoma** and it is held open by an artificial airway called a **tracheostomy tube**. A child is able to breathe and cough through the tracheostomy tube as long as it stays clear and does not get blocked.[1]

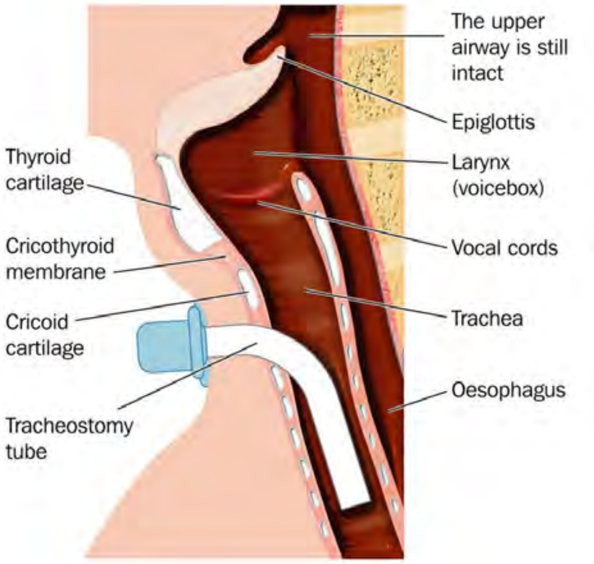


Figure 1 Tracheostomy Tube Side View Alila Medical Media Shutterstock_48386533

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

There are three main reasons for needing Trach Tubes:

1. Open the airway:
   There may be a narrowing in the airway that blocks airflow from passing through the windpipe, or trachea, to the lungs. The tracheostomy tube will allow air to flow in and out of the lungs, past the narrowing.

2. Protect the airway:
   Our body naturally protects us from choking with reflexes: gag, swallow, and cough. If these reflexes are not working well, the lungs are not protected from pieces of food, or fluids that were meant to go down the esophagus to the stomach. Food or fluids that go down the windpipe and into the lungs could cause a serious lung infection.

3. Long Term Mechanical Ventilation:
   There may be a problem with either or both of the following parts of the breathing, or respiratory system:
   - the brain doesn't send messages to our breathing muscles as it should
   - the breathing muscles are too weak to move the chest[1].

My child needs a tracheotomy tube because:

____

If unsure, ask your child's Doctor!

C. PARTS OF TRACHEOSTOMY TUBE

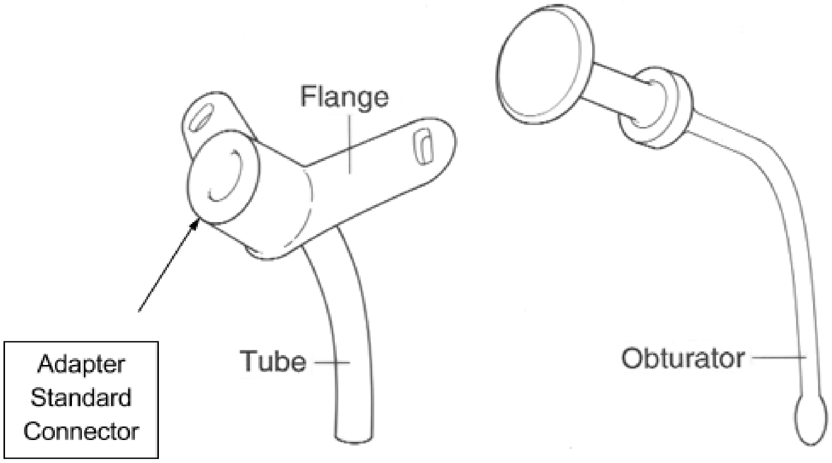


Figure 2 Tracheostomy Tube Parts
Used with Permission from Marc Tessier RN CHEO Tracheostomy Manual

The main parts of a tracheostomy tube are the tube (cannula), the flange, the obturator, the adapter and the ties.

Tube (cannula)

- The cannula is the most important part of the tracheostomy tube. Air flows in and out of the lungs through this tube.

Flange

- The flange rests against the neck. The flange extends from the sides of the tube and has holes for tracheostomy ties to pass through. These ties keep the tube in place.
- The flange is also an important source of information. Markings on the flange generally show the manufacturer's name, the patient (Neonate or Paediatric), the size or inner diameter of the tube, as well as the outer diameter and length (not on all tubes).

Obturator

- The obturator is specially made for the size of tracheostomy tube in that package. You must not use an obturator from one size trach tube to put in a tube that is a different size.[2] (15)
- Keep the obturator at the bedside in case the trach tube falls out accidentally.
- It fits inside the tube to guide the tracheostomy tube as it is being put in.
- The obturator also prevents the tube from getting blocked with mucus as it is going in.

IMPORTANT!
The obturator is only used when inserting the tube into the stoma. It must be removed a soon as tracheostomy tube is in place because it blocks the trach from allowing air in and out!

IMPORTANT!
Keep the obturator somewhere where it is easy to find. It 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.

Adapter

- Opening of tracheostomy tube
- Suction catheter may be passed through to clear secretions
- Standard sized connector for attaching a heat moisture exchanger, a speaking valve, ventilator circuit, and cough assist tubing should they be prescribed

Ties or Holder

- Ties are used to hold the tracheostomy tube to the neck so it will not fall out
- There are foam, Velcro®, and twill ties
- Care must be taken when putting on the tracheostomy ties on. They should not be tied too tight or too loose. When tied correctly you will be able to fit one or two fingers between the tracheostomy ties and the neck

D. TYPES OF TRACHEOSTOMY TUBES

There are many kinds of tracheostomy tubes. They can be made from rubber, plastic, silicone, nylon, Teflon, polyethylene, or metal. All tracheostomy tubes are made with non-toxic materials. Everyone has a different sized neck, so the tubes come in different sizes.

Tracheostomy Tubes are different for the following reasons:

Trach Tube Manufacturer

- 'Bivona' and 'Shiley', are the most common trach tube brands used for children.[4]

Patient

- Tracheostomy tube will be labeled and sized for a Neonatal, Paediatric or an Adult patient.
- The angle and length of cannula are designed to meet the needs of a child's growing airway.[1]
- Remember that at birth the airway is very high and forward in the neck and the smallest part of the airway is below the vocal cords.
- The angle of the trach tube will change as the airway grows and moves down and back into the neck.
- The smallest part of the airway in the older child and teen is now at the vocal cords.

Tube Size

- The tube size refers to the size of the **Inner Diameter** of Cannula
- The tube size tells you how wide the opening of the cannula is in millimeters (mm)
- Your Ear Nose and Throat Doctor will decide what size of tracheostomy tube is best for your child.

- There are many factors which affect the choice or size and manufacturer:
  - Your child's medical condition
  - The age & size of your child
  - The size of your child's airway
  - The reason for a tracheostomy tube
- The tracheostomy tube needs to be small enough to protect the inner wall of the trachea and allow your child to speak, but not so small that a large leak around the tube causes breathing difficulties, especially during sleep.
- As a child grows, the tracheostomy tube has to be up-sized once every two years especially between age of 1 month and 4 years.
- The length of tracheostomy tubes then can vary from 5 cm to 15cm and the width of the opening (inner diameter) can vary from 2mm - 12mm

Single and Double Lumen Cannula

- **Single-cannula** tracheostomy tubes are the most common tracheostomy tube for babies and young children.[1] (3)
- If you think about how small a 2-4mm opening is you will quickly understand why small children do not have an inner cannula, the opening is simply too small. **Double-cannula** tracheostomy tubes are more often seen in adult size children and teenagers.
- In adult sized trachs, the cannulas are larger and there is enough room for a removable inner cannula.
- This inner cannula can be taken out of the trach tube to be cleaned.
  Inner cannula may be reusable or disposable.
- For older patients, the double-cannula is very convenient! If a mucus plug blocks the tube, the inner cannula is easily removed and patient immediately has an open airway to breathe through again.

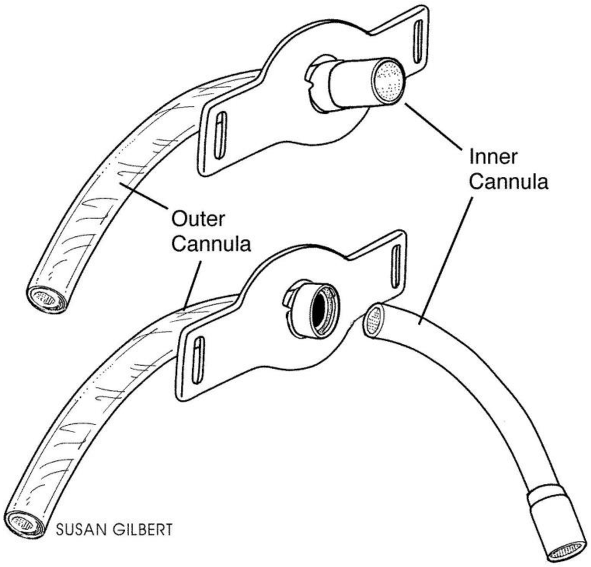


Figure 3. Double Cannula Tracheostomy Tube http://www.tracheostomy.com/images/drawings/double_cantube.gif

Cuffed Tracheostomy Tubes

When a trach tube is cuffed there is a balloon at the bottom of the trach called a cuff. The cuff seals the airway when it is inflated, or 'up'. When the tube in uncuffed, some air may pass around the trach tube and move up through the mouth and nose to allow for vocalization in babies and speech in older children.[2] (11) See **Section: 2: I Other Information About Trach Tubes** for more information about cuffed tubes.

IMPORTANT!
The parts of the tracheostomy tube are all very important information to understand if you are caring for someone with a trach tube.

- Most of the information you need is found right on the tracheostomy tube and the box it is packaged in.
- Some patients require a custom tracheostomy tube in order to provide a secure airway. These custom tracheostomy tubes are ordered by the child's Ear, Nose and Throat Doctor.

Please fill in your child's Tracheostomy Tube Details:

My child needs a Tracheostomy Tube because:

____

Date of Tracheotomy Surgery: ______________________________

Manufacturer of Trach Tube: ______________________________

Size of Trach Tube:____________________________________

Neonatal or Paediatric: _________________________________

Custom Trach: **Yes** ☐ **No** ☐

Double Cannula ☐ **Single Cannula** ☐
Cuffed Trach: ☐ **Uncuffed Trach** ☐

For Cuffed Trachs:

Inflate cuff with ________________ **ml of air**
Inflate cuff with ________________ **ml of sterile water**

E. HOW DO I KNOW WHEN I SHOULD REPLACE THE TRACHEOSTOMY TUBE?

The general guideline for replacing a trach for a new one is every 30 days, or once a month. However, it is not unusual for Neonatal trach tubes to need changing as much as every week and sometimes more often during colds or chest infections. The width of the tube is very small (think of a cocktail straw) and will block easily with mucus.[3,8] Please see **Section 2:O Changing the Tracheostomy Tube.**

Note: *Young children find it quite entertaining to pull out their tracheostomy tube!*
Children 5 years old and younger seem to find this very amusing. You may find yourself greeted with a big smile as your child throws the tracheostomy tube over the crib and onto the floor. Try

not to overreact, remain calm, and replace the tracheostomy tube. The less you react, the less entertaining for your child[1]. They will soon get tired of that trick because of having to have the tube put back in. Your care team will be sure you are confident at changing the tracheostomy tube well before you go home.

The trach should be replaced every ________________ and as needed.

This will be determined by your care team prior to discharge home. Ask your Doctor if you are unsure.

F. WHERE SHOULD I DO MY TRACH CARE?

- Trach care can be done anywhere, but an area that is private and away from distractions is helpful. Make sure that your child is away from open windows, heating ducts, and fans to limit the spread of dirt and dust. Pets should not be allowed in the room.
- It is best to do trach care at the same time of day to establish a routine with your child (e.g. morning or bedtime)
- It usually takes 20-45 minutes to complete trach care

G. STOMA CARE

- Be sure to look at the stoma every day so you can easily notice a change in the skin around it, should it change.
- Watch for too much moisture, pooled mucus, redness, swelling, or growth of scar tissue (granuloma) at the site.

Figure 4. Granuloma
Used with Permission from Marc Tessier RN
CHEO Tracheostomy Manual

- A granuloma (See Figure 4 above) requires attention if it is getting in the way of trach tube insertion or if it looks sore and infected.
- Granulation tissue often forms when there has been irritation, swelling, or a lot of leaking of mucus around the trach tube. Good stoma care can help reduce the risk of a granuloma developing.
- Skin at the tracheotomy site needs to remain clean and dry. If drainage is left to collect around the tracheotomy tube, germs can grow and cause infection or skin breakdown.
- Stoma care should be done every time you change your child's tracheostomy tube ties. If your child has a lot of secretions, you should clean the site even more often.

IMPORTANT! Please have a second person to bundle or hold child during trach tie changes, stoma care, and trach tube changes.

Supplies for Stoma Care:

- Sterile Distilled Water
- Cotton Swabs
- Disposable Cups
- Gloves

Stoma Care Technique:

1. Wash and dry hands
2. Put on gloves
3. Set up supplies
4. Suction if needed
5. Look at the skin around the stoma, notice if there any changes
6. Pour distilled water in clean container
7. If the area around the stoma looks crusty, use a combination of Ð distilled water and Ð hydrogen peroxide. *This solution should not be used every day as it will dry out healthy skin*
8. Dip cotton swab in solution
9. Starting at the stoma, stroke away from the tracheotomy opening using one stroke per swab
10. Discard Swab
11. Repeat as necessary to cover the area around the stoma
12. Clean the flanges of the trach tube
13. Using clean, dry cotton swabs, dry the skin
14. Using a tracheostomy dressing is optional. If you choose to use them, remember that they trap moisture and if damp can cause skin breakdown. If using gauze dressing, do NOT cut fabric, the frayed fibers may be breathed in the tracheostomy tube.
15. Be sure trach ties are secure
16. Remove Gloves
17. Wash and dry Hands

H. TRACHEOSTOMY TUBE CARE

Be sure to assess the following every day:

Tracheostomy Tube

- **Is it mid line? I**f the tube is not in the middle of the windpipe, the tube may be rubbing against the inner wall of the trachea and cause bleeding or causing scar tissue (granuloma) that could become infected or even block the tube.
- **Is it secure?** A loose tracheostomy tube can be easily coughed out by a child (remember this tube may only be 5-6 cm until your child is about 2 years old) The loose tube may also move in and out, hitting against the back of the airway as the child moves and this may cause gagging or vomiting.

How to Clean Your Child's Shiley® Tracheostomy Tube

While your child's Shiley® tracheostomy tube cannot be re-sterilized, it can be cleaned and reused. This is appropriate in the home setting[2]. It is not recommended to wash the trach tube more than 3 times as long as the tube is not discoloured[1].

Supplies

- Dirty Shiley® tracheostomy tube and its obturator
- Mild soap (such as Ivory®) and water
- White vinegar
- Clean container or a new zip lock plastic bag
- Paper towels
- Pen and tape

Technique

1. Using the obturator, clean any mucus from inside the tube. Use an up-and-down movement to push out any mucus or crust.
2. Clean the tube and obturator with soap and water.
3. While cleaning, look for cracks or sharp edges. If you find any, discard the tube.
4. Rinse the tube well under running water and check the tube to see if it is clean. It may take more than one rinsing to clean it well.
5. Soak in Ð strength vinegar and water for 2-3 hours in a clean container.
6. Rinse the vinegar solution off and place the tracheostomy tube on a clean, dry paper towel to air dry.
7. Place a clean paper towel over the wet tube and obturator to protect them from collecting dust and let dry overnight.
8. Once the tube is dry, handle it by the flange only. Inspect it again for any damage.
9. Store in a clean container or zip lock bag.
10. Label with the size of the tracheostomy tube and the date cleaned on the outside of the container or bag.

How to Clean Your Child's Bivona® Tube[1]

Supplies

- Dirty **Bivona®** tracheostomy tube and obturator
- Mild soap (such as Ivory®) and water
- Pot or container for boiling water
- New zip lock plastic bag
- Paper towels
- Pen and tape

Technique

1. Use the obturator to clean and mucus from inside the tube by pushing it in and out of the tube 2-3 times.
2. Clean the tube and obturator with mild soap and water.
3. Check the tube for any cracks or sharp edges. If you find any, discard the tube.
4. Rinse tube well under warm water and check to make sure you have rinsed any mucus or crust off the inner wall of tube.
5. Boil water in a pot and remove from direct heat; or microwave water until it boils in a clean glass container.
6. Drop the tube and the obturator into the hot water IMPORTANT! Never boil a tracheostomy tube over direct heat!

IMPORTANT! Never boil a tracheostomy tube over direct heat!

7. Leave the tube and obturator in the hot water until the water cools and you are able to take them out with your bare hands.

8. Place tube and obturator on a clean dry surface such as a paper towel.
9. Cover with a clean paper towel to protect form dust and let dry overnight.
10. Store in a clean dry container or a zip lock plastic bag.
11. Label the container in a Ziploc or plastic bag.

Tracheostomy Ties

Changed daily or whenever the ties become wet or dirty. The two most common types of ties that we use with children are Dale Tracheostomy Tube Ties and Twill Ties.[1]

Dale Tracheostomy Tube Ties

Velcro-type fasteners are generally 1 or 2 pieces of foam material connected to the tracheostomy tube using with Velcro strips. The most commonly used brand is the Dale Tracheostomy Tube Fastener.

Although Velcro fasteners are softer and preferred because they are easy to use, they may not be appropriate for all children. They may be more likely to cause the trach to fall out, or **decannulation**. This can happen with an active toddler, or a child who is agitated.

Advantages of Dale Ties:

- Easy to apply
- Softer on skin
- Designed to draw humidity away from skin
- Can be washed and reused

Disadvantages of Dale Ties:

If the child is able to pull on the Velcro, it can lead to the trach tube accidentally coming out. If using self-fastening ties, you must check the self-fastening ties often throughout the day to make sure the Velcro is still secure.

If cleaning and reusing Velcro ties, the ties must be checked before each use to see whether Velcro hold is still strong. They should only be washed in mild soap and water, and line dried.

Supplies

- Dale Tracheostomy Tube Tie
- Scissors
- Suction
- Emergency Kit

IMPORTANT! You will need a second person to help with the trach tie change. The second person will hold the tracheostomy tube in place while you change the ties.

Technique for Dale Trach Tie Change

1. Wash and dry hands.
2. Take a new tie and open its Velcro strips. Adjust the tie, so that it will fit comfortably around your child's neck. You will make final adjustments to the tension once the tie is in place.

The Dale tracheostomy tie is a two-piece neckband, requiring adjustment to ensure a proper fit. Most families like to pre-measure the length of the Dale tracheostomy tie and trim off excess material from the neckband before changing the tie.

3. Position your child comfortably on their back. Slightly hyperextend the neck to make it easier to work at back of neck. Placing a small rolled-up towel under the shoulder blades of younger children can help keep to head in proper position.

If you are worried that your child may move around too much or grab at tracheostomy site during tie change, you may want to bundle them with a blanket before going any further. Make sure that you bundle arms as well.

4, Movement of the tracheostomy tube while changing the ties may make your child cough, so be sure your assistant has a good grip on the tube before you start.

Have your assistant hold down the tube using light, but firm pressure on both flanges. Do not let go of the tube until the new tie is securely fastened.

5. Untie and remove the existing flange tab Velcro-type tie, making sure you do not pinch skin.
6. Wash the side on the neck with soap and water. Rinse and dry well.
7. Thread long, narrow fastener tab through the hole in the flange furthest from you
8. Fold the Velcro tab back over flange and stick neckband.
9. Guide the new Velcro tie around the back of your child's neck, making sure that the padded side is facing the skin.
10. Have your assistant turn your child's head to other side, while keeping the tracheostomy tube in place.
11. Wash the other side of the neck with soap and water. Rinse and dry thoroughly.
12. Thread and secure second fastener tab into flange hole closest to you.
13. Check the ties and see that only one finger can slide under the ties. Be sure the tie lies flat against the neck and there is no slack in the tie.
14. Flex your child's head slightly to make sure the ties are secure in all positions. You may also want to sit your child up as check that only one finger can slide under the tie.
15. Adjust tightness of ties as necessary.
16. For infants, check tightness 15 minutes later to verify that tightness of ties is appropriate and adjust as necessary.
17. Wash and dry hands.

IMPORTANT! Infants tend to "bull" their neck during the procedure in an effort to pull back. When they relax their shoulder muscles, the ties may be too loose and may cause an accidental decannulation (tube coming out).

Twill Tie Change
Twill tape is a flat twill woven cotton or polyester ribbon.

Advantages of Twill Ties:

- Difficult for a child to untie
- Relatively inexpensive

Disadvantages of Twill Ties:

- Can cause irritation and ulceration of the skin due to width and knot.

Supplies

- Twill Tracheostomy Ties
- Scissors
- Suction
- Emergency Kit

IMPORTANT! You will need a second person to help with the tie change. The second person will hold the tracheostomy tube in place while you change the ties.

Technique for Twill Trach Tie Change

1. Wash and dry hands.
2. Set up supplies.
3. Cut one piece of cotton twill tie long enough to fit twice around the neck. Also allow extra twill tie for tying.
4. Cut new twill tie at an angle to prevent fraying. The angled cut will also help in threading the ties through the holes in the tracheostomy flange.
5. Position your child comfortably on their back.
6. You may wish to slightly hyperextend the neck, in order to make it easier to work on back of neck. Placing a small rolled-up towel under the shoulder blades of younger children can help keep to head in proper position.

If you are worried that your child may move around too much or grab at the tracheostomy site during tie change, you may want to bundle them with a blanket before going any further. Make sure that you bundle arms as well.

7. Movement of the tracheostomy tube while changing the ties may make your child cough, be sure your assistant has a good grip on the tube before you start.

Have your assistant gently but firmly place fingers on the tracheostomy tube flange on each side of the tube outlet to hold it as close to the neck as possible throughout the rest of the procedure.

8. Cut existing twill tie between knots and nearest flange.
9. Remove old twill tie and wash the side of the neck with soap and water. Rinse and dry thoroughly.
10. Thread one end of clean twill tie through the hole in the flange and bring the ends of the tie together behind the neck.
11. Have your assistant turn your child's head to other side while keeping the tracheostomy tube in place.
12. Wash the other side of the neck with soap and water. Rinse and dry well.
13. Bring the end to the new twill tie closest to the neck through the hole in the flange. Make sure that there are no twists in the tie.
14. Tie the ends together securely in a bow on the side of the neck.

Check the ties and make sure that only one finger can slide under the ties.

15. Flex your child's head slightly to make sure the ties are secure in all positions.
16. Sit your child up to check if tracheostomy ties are secure but not too tight.
17. Adjust tightness of twill ties as necessary.
18. Pull the ends of the bow through to form a knot. Tie a second loop to make a triple knot. Trim the ends to 2 cm (1/2 inch) in length.

19. For infants, check tightness 15 minutes later to verify that tightness of ties is appropriate and adjust if you need to.
20. Wash and dry hands.

IMPORTANT! Infants tend to "bull" their neck during the procedure in an effort to pull back. When they relax their shoulder muscles, the ties may be too loose and may cause an accidental decannulation (tube coming out).

I. OTHER INFORMATION ABOUT TRACH TUBES

What is a Cuff?

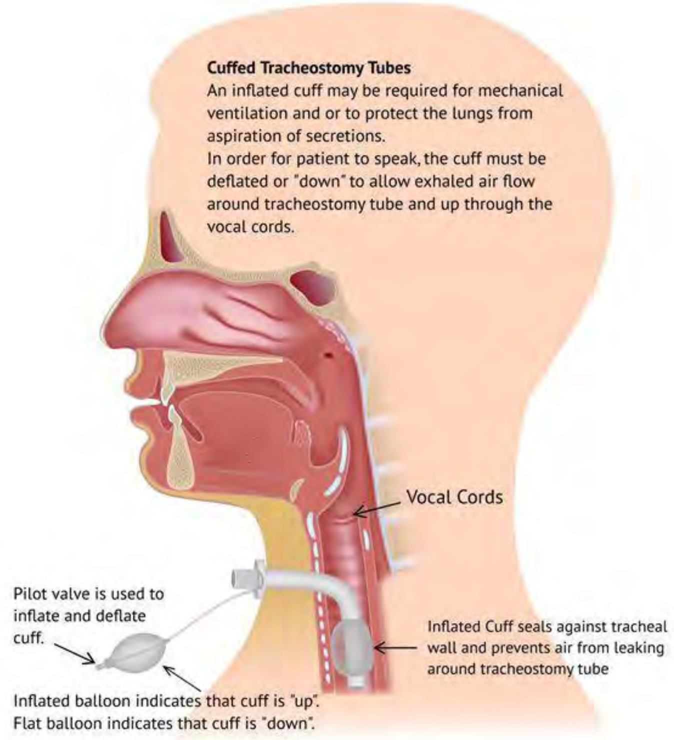


Figure 5. Cuffed Tracheostomy Tube Alila Medical Shutterstock_157672181

When the balloon is inflated, it allows the balloon to fit along the wall of your windpipe and seal it off around the trach tube. This seal may be needed if you are using a breathing machine called a ventilator, or if suctioning is required.

The cuff is inflated by putting either air or sterile 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 sterile water is in the cuff. Ask your Respiratory Therapist or Nurse how much air or sterile water needs to be in your cuff.[2(2),5(9), 9]

If the cuff is inflated or there is not enough of a leak around an uncuffed trach tube, air cannot flow around the trach tube and out through the voice box. Patients with enough leak around the trach tube with either a deflated cuff or around an uncuffed trach tube may be helped to speak by wearing special speaking valves.

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

Deflating the Cuff or Putting the Cuff "Down"

1. Suction the mouth, if needed

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 in case 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

5. You have now deflated the cuff [2(27)]

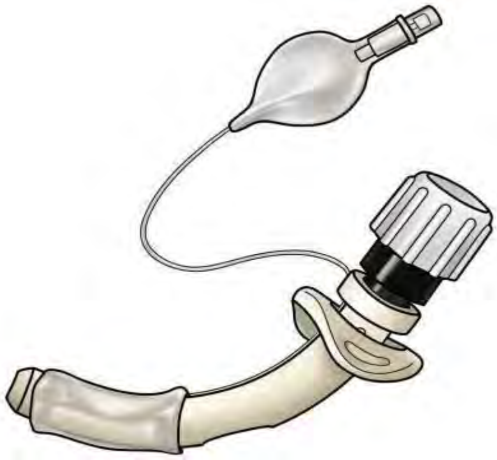


Figure 6. Deflated Cuff

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 milliliter (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 [2(27-28), 9]

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

My trach has a cuff that needs to be filled with:

_________ml of air (Shiley or Portex tubes)

_________ml of air (Shiley or Portex tubes)

Figure 7. Shiley Cuffed Tracheostomy Tube
Shiley™ XLT Extended-Length Disposable Inner Cannula Tracheostomy Tube
http://www.medtronic.com/covidien/products/tracheostomy

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 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 and if there are bubbles coming out of the balloon, there is a leak and the trach tube needs to be changed.[2 (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 this, and you are comfortable doing a trach change, then change the tube. If you have not been told what to do, or you are not comfortable, call your home care worker or Respiratory Therapist for help. If no one is available to help, go to the nearest emergency room.

J. SPEAKING VALVES

A speaking valve is a one-way valve that it placed on the trach tube. The valve allows air to go into the trach and lungs but does not allow air to come out of the trach. The exhaled air is directed up around the tracheostomy tube and through the voice box so the child can make sounds and speak. You will hear your baby cry and or child speak.

Not every child with a tracheostomy can tolerate a speaking valve. Your child will be assessed by the Ear Nose and Throat Doctor, a Speech Language Therapist and a Respiratory Therapist before using a speaking valve. This team will do their best to start speaking valve trials as soon as possible and teach you how to use it at home. Speaking valves may also be used for children on mechanical ventilation, or breathing machines.[10]

Often, there is just not enough room around the Neonatal and Paediatric tracheostomy tubes to allow for speaking valve use in very small children.

Do not give up! The benefits of using a speaking valve are very important!

Remind your medical team to keep trying and encourage your child as well with lots of positive reinforcement each time they put it on, even for a few minutes.

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

Speaking valves can improve:

- Swallowing normal secretions and eating and drinking from the mouth. Being able to do these things reduces the risk of choking and getting chest infections
- Smelling. When the child can smell, it encourages eating and drinking (breast or bottle), which supports bonding with family
- Coughing and airway protection
- Use of a speaking valve allows for stronger coughs. With stronger coughs, your child will not need to be suctioned as often.[2(29),10]

Speaking Valves should be removed during:

- Sleep
- Suctioning
- inhaled medications

Figure 8: Passy-Muir® Tracheostomy Speaking Valve http://mcarthurmedical.com/product/passy-muir-valve-venttrach-spk-valve

How Do I Clean My Speaking Valve?

Clean the speaking valve every day using a mild soap and warm water.
Rinse well. Allow to air dry. When dry, store it in sealed plastic container.[2(30), 10]

- Some cleaning products will damage the valve. Do not use the following to clean the speaking valve:
    - Hot water or harsh chemicals
    - Hydrogen Peroxide,
    - Bleach
    - Alcohol
    - Cleaning brushes

K. EMERGENCY TRACH KIT

IMPORTANT! Make sure that the child has the Emergency Kit with him/her at all times!

Put the following things in your Emergency Kit:

1. 1 Tracheostomy Tube (Same Size)
2. 1 Tracheostomy Tube (One Size smaller)
3. 1 Dale Tracheostomy Tube Holder and/or Spare twill trach ties
4. Scissors
5. Sterile lubricant packet (Muco, KY)
6. Sterile saline packs (Addipaks)
7. Suction catheters (Appropriate size)
8. 1 DeLee suction device (Appropriate size)
9. Swedish noses (as required)
10. Self Inflating Bag & Oxygen tubing
11. Gloves (optional)
12. Saturation Probe (optional)
13. Portable Suction Unit (charged)
14. Oxygen Saturation Monitor (if prescribed)
15. Oxygen Tank (if Oxygen prescribed)

You may also want to carry your emergency telephone contact list, a brief medical history, list of current medications and ventilator settings if your child uses a breathing machine **(See Section 9: Emergency Contacts & Planning).**

Figure 9. Emergency Kit Supplies
Used with Permission from Marc Tessier RN CHEO Tracheostomy Manual

What is a DeLee Suction Trap?

The DeLee suction trap is made of plastic and can be used in an emergency. It is used when an electrical suction machine is not near or not working. Always carry a DeLee suction trap when traveling with your child. If you need to use it, throw it once you get home and be sure to pack a new one in your emergency kit.

To use the DeLee suction trap:

1. Put the tube with holes at the end into the trach.
2. Put the tube with a mouthpiece in your mouth.
3. Put a finger over the hole in the tube near your mouth while sucking on the tube in your mouth, like a straw.

The mucus goes from the tracheostomy into the trap. Mucus does not go into your mouth.

Figure 10. DeLee Suction Trap
Used with Permission from Marc Tessier RN CHEO Tracheostomy Manual

L. SPECIAL CONSIDERATIONS: LIVING WITH A TRACHEOSTOMY

Humidification

Your child will be prescribed a humidification device for naps and overnight. These usually deliver humidified air to your baby through a trach mask, or trach ‘hood’. The humidified air helps to keep secretions loose and prevents them from getting crusty and difficult to cough up or suction out. During the day, your child may be prescribed to use a heat moisture exchanger (HME). These devices will be reviewed in **Section 7: Humidifiers**. Before your child is discharged from the hospital, your medical team will work with you and a medical supply company of your choice to get a humidification device, HME, and any other equipment you will need. You may find it helpful to use a space humidifier in the home. The easiest way to humidify and ensure that your child’s secretions do not become thick and sticky is to give lots of fluids. Babies with trachs who drink by mouth or tube should have their water intake monitored very carefully.

Feeding/Eating

Most babies and children with tracheostomies will have no problems feeding. However, some may have trouble. Your child may find it hard to swallow saliva, or cough during feeding. Food or fluid may come out from the tracheostomy. If your child is having swallowing difficulties, the Speech Language Therapist will assess your child and, along with the medical team, suggest ways of improving his or her feeding.

Babies

Most babies with tracheostomies can be fed like any other baby. However, the following precautions should be taken while feeding:

- Feed your baby in an upright position
- Bottle-fed infants should be burped often
- Always hold the feeding bottle. Never use something to prop it up
- Never leave baby alone with a bottle in case they start to choke
- Avoid getting any food products in the tracheostomy tube. If feed should accidentally get in the opening, suction the airway immediately.
- It is safe to breast-feed a baby with a tracheostomy. Just make sure you are not blocking off trach tube opening during feeding.
- Older brothers or sisters can help with feeding, but an adult should always be there observing closely.

It is a good idea to suction your child before a feed, as children tend to get more secretions with feeding. Suctioning before feeding may also prevent the need to suction during feeding, or right after feeding. Coughing brought on by suctioning may cause the baby to vomit. Suctioning before a meal is also a good idea for children that are tube fed.

Children

Don't let fingers or food get in the trach tube. Give plenty of fluids each day to help keep secretions thin. Avoid suctioning right after a meal, if possible, to minimize the risk of vomiting.

If the child is safe to eat by mouth, here are a few tips to make swallowing easier:

- Have the child sit up as straight as he/she can.
  If possible, use the speaking valve during meals. This will allow the child to taste the flavour of the food, hopefully encouraging him/her to eat more.
- Have the child tilt his/her head slightly forward. Encourage him/her to tuck their chin slightly downward.

Bathing and Hair Washing

Water can be hazardous for a child with a trach. Sponge baths, or shallow tub baths may be taken with strict caregiver attention. Always stay with your child when he or she is near water. Make sure that the water line is well below the tracheostomy, and avoid too much splashing. The use of a non-slip bath mat is also a good idea. Your suction device should always be handy and working, just in case. Remember, water and electricity do not mix: never have a suction device plugged in near a water source.

Infants should be sponge-bathed with caution to avoid water being allowed to run down the trachea. Older children may take tub baths, under close visual observation.
Small children should not be allowed to shower.

Older children may shower, but precautions must be taken to shield the tracheostomy opening from water. If you have an adjustable shower head, adjust it to hit your child's body well below the neck area. Before introducing showering to your child's care, discuss with your Doctor. For hair washing, the child may be laid on his/her back, or held tipped back in the bath. The hair can then be washed by spraying, or pouring water from a cup.

Clothing

Avoid clothing that blocks the trach tube. Avoid clothing that sheds fibers (e.g. angora, wool sweaters). Clothing should not be made of material that frays easily nor has fine, furry, or fuzzy fibers. Soft toys that shed should also be kept away from your child.

Avoid necklaces, medallions, or small objects on strings around the neck that could fit into the trach tube

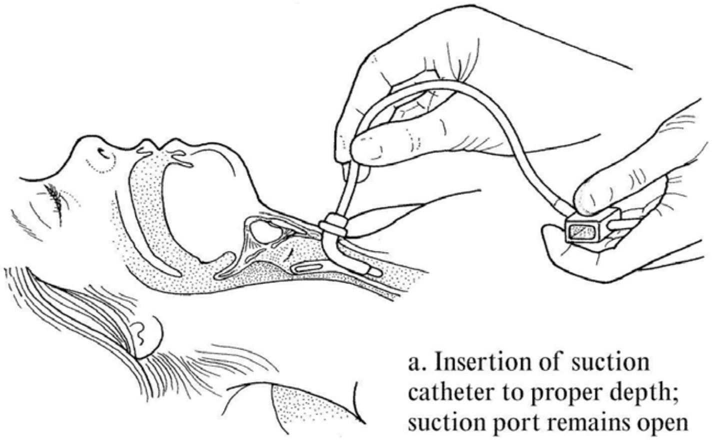
Environment

Lightly cover the trach tube with a scarf, kerchief, or gauze in cold weather or windy days. Avoid exposure to dust, mould, and smoke from tobacco or other sources.

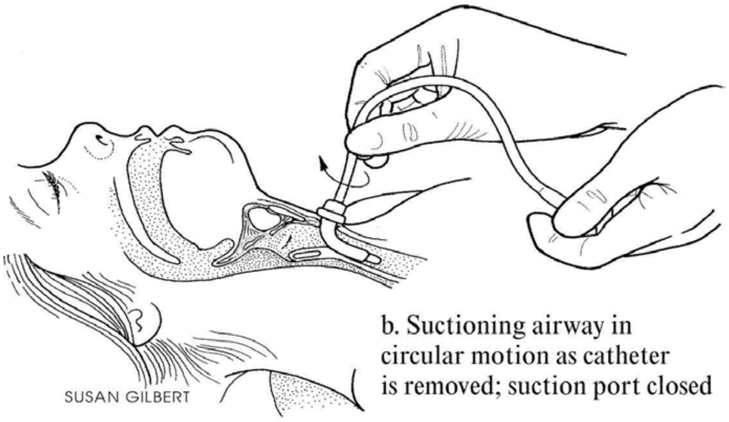
Avoid fumes from cleaning solutions such as ammonia, bleach, furniture polish, or other strong smelling solutions. Use damp dusting and vacuuming to clean the house. This will reduce the amount of dust [5 (26), 11 (5)]

H. TRACHEAL SUCTIONING

Please also see **Section 8:E Lung Recruitment & Pulmonary Clearance Techniques- Suctioning** for tracheal suction.



a. Insertion of suction catheter to proper depth; suction port remains open



b. Suctioning airway in circular motion as catheter is removed; suction port closed

Figure 11 Suctioning Tracheostomy Tube Used with Permission from Marc Tessier RN CHEO Tracheostomy Manual

Suctioning is a way to remove mucus from the trach tube and keep it clear so your child can breathe easily. Suctioning is done with a smaller tubing called a catheter that is 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 mucus, but also air from the lungs.

How Do I Know How Far Down I Should Suction?

How deep you go with the suction catheter depends on the size of trach tube. The suction catheter should be put in 0.5 cm further than the length of trach tube. The obturator may be used as a measuring guide.

For a Shiley® tracheostomy tube, it is very easy to figure out how far you should suction. You simply add 2.5cm to the length of the tracheostomy tube written on the box.

To make it even easier, you can then round the number off to the nearest Ð cm.

Shiley® **Recommended Suction Depths**

		Inner Diameter (cm)	Outer Diameter (cm)	Length (cm)	Length (cm) + 2.5cm	Suction Depth (cm)
Neonatal	**3.0 NEO**	3	4.5	3.0	5.5	**5.5**
	3.5 NEO	3.5	5.2	3.2	5.7	**6.0**
	4.0 NEO	4	5.9	3.4	5.9	**6.0**
	4.5 NEO	4.5	6.5	3.6	6.1	**6.0**
Pediatric	**3.0 PED**	3	4.5	3.9	6.4	**6.5**
	3.5 PED	3.5	5.2	4.0	6.5	**6.5**
	4.0 PED	4	5.9	4.1	6.6	**6.5**
	4.5 PED	4.5	6.5	4.2	6.7	**7.0**
	5.0 PED	5	7.1	4.4	6.9	**7.0**
	5.5 PED	5.5	7.7	4.6	7.1	**7.0**

Figure 12. Shiley TT Recommended Suction Depths
Used with Permission from Marc Tessier RN CHEO Tracheostomy Manual

My suction unit pressure is set at: ______________________________
(Normal suction pressure range: 80-100mmHg)

Size of suction catheters to be used is: ___________________________ Fr

The depth of my suction catheter is: _____________ cm (length of TT + 2.5 cm)

A Few Helpful Hints

Use your fingers as a guide. Many catheters come with measured markings on them. Place your fingers on the desired suction depth on the suction catheter and you can be assured that you will not go down the tube any further than you should.

If your suction catheters do not have measured markings, measure and cut a piece of tape which reflects the desired suction depth. Place that piece of tape on your child's suction machine or bedside. You now have a quick and easy reference tool to check your finger placement on the catheter.

Suctioning is considered a clean process and you want to keep the area and procedure as clean as possible. You do not want germs to enter into the trach as they can cause a lung infection. It is not a sterile process. You or the person doing the suctioning may wear masks and gloves so that the mucus and germs are not transferred to them[2(33-37),11(7-8)].

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

Supplies:

- 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

Technique for Suctioning a Trach

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

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

6. Hold the catheter at the desired suction depth

IMPORTANT! You do not want to go any further that 0.5cm past the end of the tube.

7. Remove the cork, trach mask, ventilator or manual resuscitator bag from the trach, if needed
8. Gently put the catheter to the depth determined for size of trach (0.5cm longer than trach tube) 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.

9. If you hit resistance, pull back slightly
10. 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 pulling catheter out of trach tube

IMPORTANT! The suction catheter should not be in the trach for more than 15 seconds.

11. 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, remove it and use a new one

12. If age appropriate, ask the patient "Do you need to be suctioned again?" Suctioning is needed if you hear "gurgling" sounds during breathing. Repeat as needed to clear secretions.

IMPORTANT! Suctioning can cause the child to feel very short of breath! Take breaks between suction attempts. You may need to place the child back on ventilator for a while or give them some manual breaths with the resuscitation bag in between the suctioning sessions to relieve shortness of breath.

13. Look at the mucus being suctioned out. Take note of the amount, the colour, the thickness and the smell
14. 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
15. 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
16. Turn off the suction unit
17. Empty and clean the suction drainage bottles and containers, if needed
18. Wash hands well
19. 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 [2(33-37),11(7-8)].

When should I suction?

- Only suction when needed.
- How often you need to suction will vary from child to child and will increase when your child is ill.
- Try to avoid suctioning too frequently.
- Your child's age and the reason they needed a tracheostomy will also determine how often your child needs to be suctioned.[12]
- A baby or toddler may need more frequent suctioning because of crying, a less efficient cough, and more frequent colds.
- An older child may need suctioning only occasionally when they are healthy and more often when he or she is sick.
- As you spend time with your child, you will come to know his/her normal breathing pattern. What you see, feel and hear will tell you when to suction your child.

Your child may need to be suctioned if you notice any of the following:

- Rattling mucus not cleared with coughing
- Bubbles of mucus at tracheotomy opening
- Dry raspy breathing or a whistling noise from tracheostomy
- Difficulty breathing (dyspnea)
- Faster rate of breathing
- Colour changes (pale skin, blueness of toes/fingers or around lips)
- Anxiety or restlessness
- Decreased breath sounds
- Older children may verbalize, or signal a need to be suctioned
- A drop in oxygen saturation
- Frightened look
- Flared nostrils (nostrils become wide)
- Clammy skin
- Decrease in chest rise for child on a ventilator

Routine suctioning can include the following times:

- When they wake up
- Before and after feeding/meals
- At bedtime
- Before and/or after procedures/interventions (i.e. trach change, immunization injections)

Why does your child feel so short of breath when they are suctioned?

- When you are suctioned the procedure removes the mucus and some of the air from the lungs.
- For this reason try to keep the suction time to less than 15 seconds and rest between each attempt.
- You may also use a manual resuscitator, before and after suctioning. This often helps child feel less short of breath and may help move mucus further up the tube and easier to suction.

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 there was too much force when placing the suction catheter into the airway and trach tube.
- If you always gently push the suction catheter into the trach tube you should not have any bleeding.[2(36),11(7-8)]

Suctioning on the Go

Before going out make sure the portable suction unit is fully charged and that you have all supplies in the stroller or a back pack.

- Suction catheters appropriate size
- Connecting tubing
- Gloves
- Masks

- Hand sterilizer
- Distilled water, if desired
- Spare inner cannula, if applicable
- Manual resuscitator
- Emergency Trach Kit

N. OTHER HELPFUL TIPS

- You should only use one suction catheter for each suction session.
- If the catheter becomes blocked with secretions, 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 manual self inflating resuscitation bag before and after the session which may help move mucus higher in the airway and help with breathing

O. CHANGING THE TRACHEOSTOMY TUBE

It is important that all family members are familiar with the procedure in changing the trach in case of an emergency: if it becomes plugged or falls out.[1, 2(38-40) 5(18-19)]

A trach change simply means you take out the old tube and put a new trach in its place. Families often believe that their child will not be able to breathe while the tube is out or that the stoma will close as soon as the tube is removed. This is not true, your child will generally breathe freely while the tube is out and it takes hours if not days for a well established stoma to close.[1] The only time you need to feel more pressure to replace as quickly as possible is if your child is completely dependent on a breathing machine. With practice comes comfort. We encourage you to take advantage of as many opportunities you can get to change your child's tracheostomy tube.

Supplies for Changing a Trach

- A clean or new trach tube, same size as the one in place
- A trach tube one size smaller in case of emergency and the new one cannot be put in
- Tracheostomy ties (Velcro fasteners or twill)
- Supplies needed for stoma care
- Supplies needed for tracheostomy tie change
- Sterile distilled water
- Manual resuscitation bag and mask
- Water soluble lubricant
- Suction machine and suction catheter

Technique for Changing a Trach

1. Wash your hands well and put on clean gloves.
2. Check the new tracheostomy tube for any cracks or problems with the tube.
3. To keep the tube as clean as possible, touch only at the flange.
4. Put the obturator into the new tracheostomy tube.
5. Lubricate the end of the new tracheostomy tube with a water soluble lubricant.
6. Make sure the child is comfortable and lying on their back with their neck tilted slightly backward. To do this, some people find it helpful to put a rolled towel under their shoulders.

7. Clean stoma as needed.
8. Suction as needed. (It is recommended that you suction your child just before a tracheostomy tube change as it will reduce the amount of mucus in the general area.
9. Have the second person hold the trach tube at the flange while you remove the old tracheostomy ties.
10. Guide the new trach tube into the stoma, once again using a motion the follows the curve of the trach tube.
11. As soon as the new tracheostomy tube is in, remove the obturator.
12. Fasten the tracheostomy ties.
13 Wash your hands

Risk Factors for Difficult Trach Tube Changes

- When the stoma is scarred, or has granulation tissue
- When the trachea is not midline
- When the trachea is narrowed or smaller than normal
- When the person is an infant or child
- When the child has a short or chubby neck
- When the tube must be placed quickly in an emergency

Positioning of Child

Figure 14. Positioning for Tracheostomy Change
Used with Permission from Marc Tessier RN CHEO Tracheostomy Manual

A small rolled towel or blanket placed under your child's shoulders will help properly position his/her neck for the tracheostomy tube change. Your child's neck needs to be slightly extended. This will allow you to see the stoma and allow for the tube to slide without force[1]. A neck that is overly-extended makes insertion more difficult.

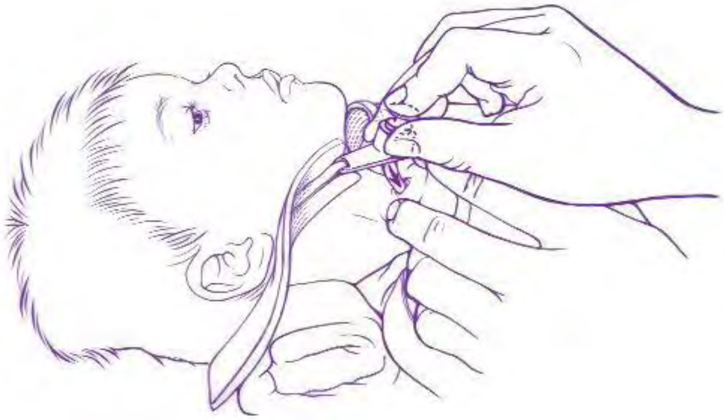


Figure 15. Insertion of Tracheostomy Tube
Used with Permission from Marc Tessier RN CHEO Tracheostomy Manual

Young babies and small children often like to be swaddled, or bundled up in a blanket, when having their tracheostomy tube changed. Swaddling also keeps hands and fingers out of the way, making it easier for the people changing their tube[1].

Other children hate the feeling of being unable to move. They feel trapped and fearful. These children will sometimes do better not being bundled.

Some toddlers like sitting up while their tracheostomy tube is being changed.

As both you and your child get more comfortable with the procedure, you will find out what works best for you.

Figure 16. Swaddled Baby
Used with Permission from Marc Tessier RN
CHEO Tracheostomy Manual

Removing and replacing the cannula may cause your child to cough. This is normal.

Movement of the tracheostomy tube while changing the ties may make your child cough, so be sure you have a good grip on the tube before you start.

What if you can't get the trach tube in?

- Moisten the trach tube with sterile distilled water and try again
- Make sure you are using the obturator and that the cuff is completely deflated
- Make sure the neck is extended. You may need to reposition the child or use a rolled towel
- If the child can breathe and is not in distress: Wait for or ask the child to take a big breath in. Guide the tube in as they breathe in

Figure 17. Finger Position for Tracheostomy Insertion
Used with Permission from Marc Tessier RN CHEO Tracheostomy Manual

- Place index and middle finger on each side of stoma. (See Figure 17)
- Gently pull down downward and outward (See Figure 17)
- Wait for child to inhale and follow breath in with tube

- Try to put in a smaller size trach tube in
- 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
- 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

Another Useful Tip for Difficult Trach Change

You may also try using a suction catheter as a "guide wire" to put in a smaller size trach. (See Figure 18 below)

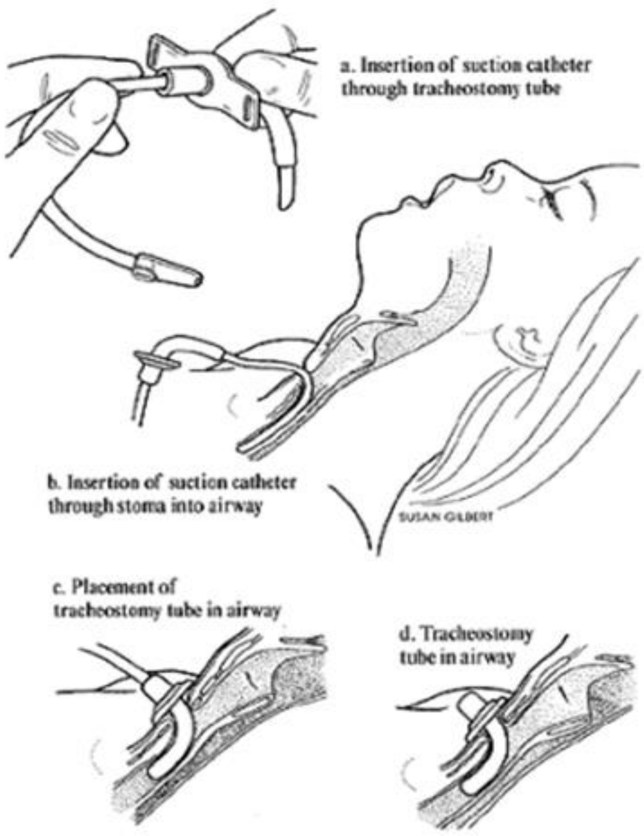


Figure 18. Using a Suction Catheter to Insert a Tracheostomy Tube Used with Permission from Marc Tessier RN CHEO Tracheostomy Manual

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?

Mucus plugs are the most common cause of respiratory distress for children with a tracheostomy.

- Blockages may come on gradually or suddenly.
- Mucus plugs may partially or completely block the tracheostomy tube.
- You will need to be prepared to handle this situation quickly and effectively.

Warning signs of A BLOCKED Trach

- Your child is unusually anxious and has a frightened look
- Your child is restless
- Your child has trouble eating
- Your child is breathing rapidly
- You hear a wheezing sound
- The nostrils flair with each breath
- The mouth, lips, or fingernails are pale bluish or dusky
- The hollow in the neck, the skin between the ribs and the skin under the breastbone may pull inwards with each breath

- If the patient is on a ventilator, you may see any or all of the following alarms: High Pressure, Low Tidal Volume, Low Minute Volume, Low Respiratory Rate.
- Check to see if child is having trouble breathing
- If so, try suctioning. If the suction catheter does not go down the trach very far then it may be plugged
- If the patient is having trouble breathing you will need to act fast. Remove the trach tube and insert a new one

P. TROUBLESHOOTING

SYMPTOM	WHAT MAY HAVE HAPPENED	WHAT TO DO
Big air leak through nose and mouth [10(20-21)]	Not enough air (or water) in the cuff	Take the air (or water) out and re inflate with the cuff with the correct amount of air (or water).
	If you have a cuffed tube, there is a leak in the cuff, cuff line or cuff balloons	Replace the tube.
	Tube too small for trachea	Call your Doctor
Tube comes slightly out of the opening in the neck [10(20-21)]	Trach tube ties too loose or incorrectly tied	Make sure tube is properly inserted into trachea and midline. Then retie the trach ties properly
Tube, or any part of the tube, breaks or doesn't work [10(20-21)]	Excessive use or wear on the trach tube	Replace the tube
	Trach tube was cleaned using improper cleaning agents	Replace the tube. Always use only those cleaning agents recommended by the tube manufacturer.
Unable or difficult to pass a suction catheter through trach tube [11(20-21)]	Mucus is plugging the trach tube	Change the trach tube if no inner cannula. If it does have an inner cannula, remove the inner cannula. If reusable inner cannula, clean and replace it. If disposable inner cannula, throw away and replace with a new, clean one.
	Catheter is too large for the tube size	Verify size of suction catheter. Contact your Home Healthcare Provider for guidance in the size of catheter needed.
	Tube is not properly positioned in the trachea	Reposition the tube and ensure it is secured properly by ties.

Q. SUPPORT AND CONTACT INFORMATION

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

1. Include all your Doctors names and phone numbers
2. Oxygen company, if you have one
3. Ventilator Equipment Pool phone number (sticker on all VEP equipment)
4. Ventilator settings
5. Trach tube information: size, type
6. Emergency Phone numbers
7. Your community healthcare support telephone number
8. Community Care Access Center (CCAC) phone number
9. Equipment supplier number, e.g. home care company

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

R. ORDERING EQUIPMENT AND DISPOSABLE PARTS

Home respiratory equipment falls under 2 categories; fully funded equipment and partially funded equipment.

The Ventilator Equipment Pool provides your child with their breathing machines, a cough assist device and home oxygen saturation monitors if they have been prescribed. This equipment is loaned to your child for as long as they need it at no charge. For help with any technical concerns or replacement of this equipment contact the VEP. Your doctor will send the appropriate application to the Assistive Devices Program and the approval is sent to the VEP. They will send the equipment to the hospital or home depending on where your child is at the time of approval.

Other equipment falls under a partial funding formula through the Assistive Devices Program as well but you or your insurance policy, if applicable, will be responsible to cover 25% of the costs. You will order this equipment from a community vendor of your choice. This is for any tubing's, connectors, tracheostomy tubes, suction equipment, or other disposable items that your child needs at home.

The medical team will help you before discharge home to order and learn how to use all the equipment that your child needs.

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3. INTRODUCTION TO HOME VENTILATION

Photo used with Family Permission

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 3C: 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 and it also displays 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)

- 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 rate (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 patient first before turning to the ventilator. This will discussed more in **Section 10: Caregiver's Assessment.**

C. INVASIVE AND NON-INVASIVE VENTILATION

Ventilation may 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. Invasive Ventilation at home. Photo used with family permission

- 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 following: PIP, PEEP, RR, VT, and O_2 (lpm)

Non-Invasive Ventilation

Figure 2. www.cpapplus.com/images/products/large/ResMed%20Pix

- 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 FiO_2

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

An individual requires total support from the ventilator when they require a breathing machine to do all of the breathing for them.[3] Patients that require total support tend to be ventilated through a tracheostomy tube. However, total ventilation 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 in 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 your child can breathe on their own, off the ventilator. For example, if the child cannot take one breath on their own, off of the ventilator, then their IBT is considered 0, or they have NO IBT. If the child 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 child's IBT is in different situations. See below for factors that can change IBT.

- Body Position
  - IBT can depend on position the child is in (e.g. sitting in wheelchair, lying flat). A child 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 child 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 the child from the ventilator, make sure you are aware of the conditions the child will be able to breathe best in on their own (e.g. sitting upright, cork off, LVR first etc). Try to optimize the child 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 children cannot verbalize that they need help because of their age or because they are too short of breath to speak. Communication is also non-verbal. Look for cues that the child is having a hard time breathing. See **Section 10: Caregiver's Assessment** for some of those cues.

IBT Can Change Over Time

Be sure to know your child'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 child has an infection. Always be prepared to respond and support breathing if a child is not able to breathe on their own. The manual resuscitation bag should be within arm's reach at all times.

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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

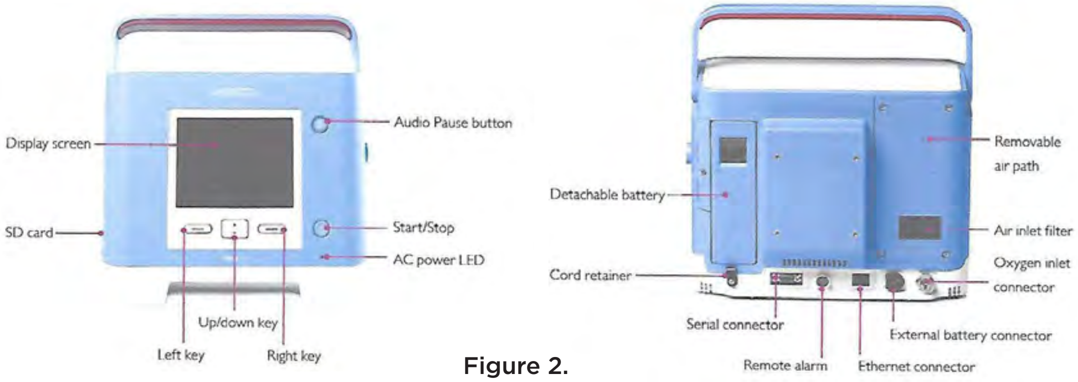


Figure 2.
http://www.philips.ca/b-dam/b2bhc/master/whitepapers/treating-restrictive-lung-disease-at-home/1061109_TrilogyWrk shpUS_Booklet.pdf

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 your child is on. Your child's personal settings are prescribed by their 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 patient is 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 (CO_2). 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: ____

Prescribed Hours of Use

While asleep ____________________

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

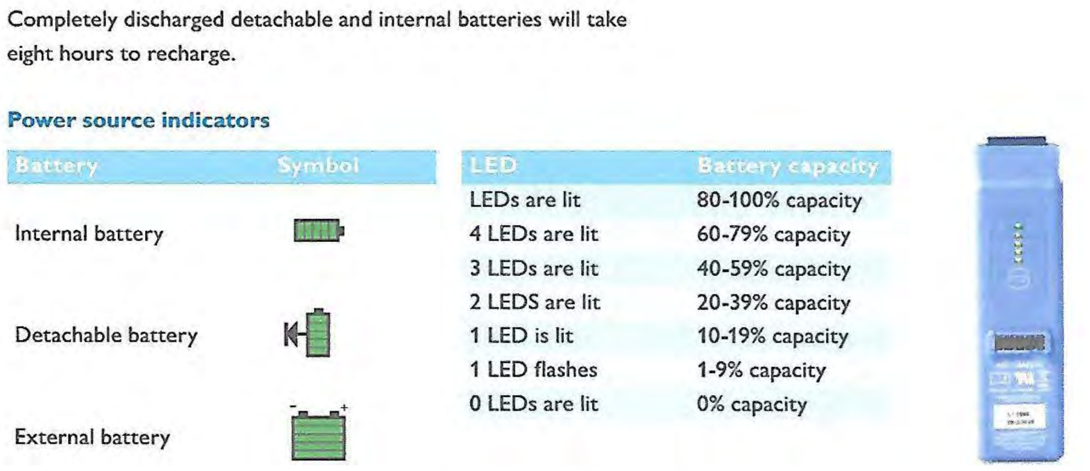
Internal Battery

- 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? [1(47-48)]

- 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.

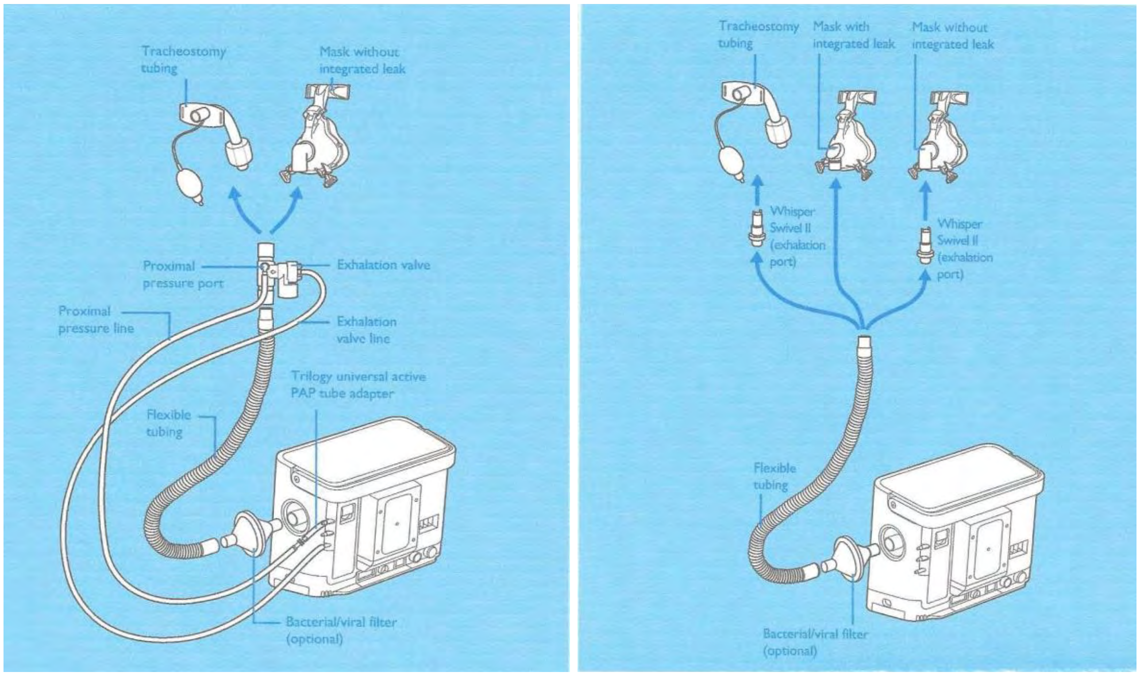


Figure 7. Quick Start Guide Philips Respironics. http://incenter.medical.philips.com/doclib/enc/9968902/T200QuickStartGuide.pdf%3ffunc%3ddoc.Fetch%26nodeid%3d9968902

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.

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

In all ventilator manuals there is a section for troubleshooting. You are asked to read this section and review it with your Respiratory Therapist. We have included some of the common alarm conditions and causes though this is not an 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
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

Figure 1. Pediatric and Infant Nasal Mask
http://www.damngeeky.com/wp-content/uploads/2016/06/Wisp-Pediatric-Nasal-Mask.jpg

Ventilation can either be Invasive or Non-Invasive. Whether or not ventilation is invasive or non-invasive depends on if your child breathes in and out of their nose and mouth or if your child has an artificial airway. If your child has an artificial airway, like a tracheostomy tube, the ventilation is "invasive". If your child does 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 your child with a small, quiet machine and an interface. The interface is the part that is put on the face. It can be a mask that goes over the nose or a mask that covers both the nose and mouth. Bilevel ventilation may or may not be intended for life support depending on the level of ventilator support needed for your child (See **Section 3: Home Ventilation**).

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 your child breathes out. This pressure is called the expiratory positive airway pressure (EPAP). This is the pressure the ventilator holds at the end of each breath. It helps to keep the lungs inflated when breathing out and prevents the air sacs in the lungs from collapsing. Your child may be prescribed a back-up respiratory rate (RR) that will support his/her breathing. For some, the backup RR is meant to provide total ventilatory support, for others, partial support.[1] In either case, with a back-up RR, if the child does not breathe at all or 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 your child. In general, Bilevel is used to treat conditions that cause hypoventilation (not breathing enough), or inadequate breathing. Your child may not breathe enough because of one single problem or a combination of different illnesses that affect the following:

- Brain or breathing command centre
- Respiratory muscles (illness that cause weakness in the diaphragm, chest wall muscles, chest wall deformities)
- Lung's ability to exchange carbon dioxide and oxygen in the blood

The following are examples of conditions that may require Bilevel ventilation:

- Neuromuscular Disease
- Sleep Disordered Breathing
- Congenital Central Hypoventilation Syndrome
- Obesity Hypoventilation Syndrome
- Kyphoscoliosis
- Achondroplasia

C. GETTING STARTED

When we sleep we do not breathe as deeply or as fast as when we are awake. If your child does not have normal lungs or has respiratory muscle weakness, they may not be able to take in as much oxygen or get rid of the carbon dioxide as well as if they had normal lungs and respiratory muscles. The Bilevel ventilator will help you to keep their oxygen and carbon dioxide levels closer to normal so that your child feels better in the daytime, is less sleepy, and has more energy.[1,2]

Masks, or interfaces, are a personal choice. There are many manufacturers of masks on the market 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 your child. Finding the best mask fit is important so that the child will wear it, as prescribed

D. LIVING WITH BILEVEL

Encouraging your child to wear Bilevel will take time and patience. Some children take months to be able to keep a mask on their face. Be positive and use any technique you know to have worked in the past with your child. Sticker reward charts, setting small achievable goals, reading or watching TV with the mask on before trying to have them wear it at night for sleep, are all very helpful. Some children feel so much better with the Bilevel that they are quite willing to wear it. Some children may take time to feel any benefit. It is in these circumstances that you will need to be firm and remain positive about the benefits of wearing it. Some of those benefits include: restful nights, more energy for school and friends, and better moods. With teenagers, a valued benefit of wearing their Bilevel consistently is that they will be able to start working towards getting their Driver's License.

Encourage your child to be as relaxed as possible and breathe normally, use a calm voice to soothe babies as they adjust to the mask. The machine responds to your child's breathing efforts to make their breathing as comfortable as possible. The Bilevel is sensing when the child starts to breathe in and gives an added pressure. The Bilevel will drop the pressure when it senses the child is breathing out.

It may take a few trials to get things right for your child. If after the trials, your child appears to be, or tells you that they are uncomfortable, call your Respiratory Therapist for suggestions and support. Adjustments to therapy may be required. The sooner problems are addressed, the more success with therapy at home. As your child gets used to wearing the mask and tolerates the pressure, slowly increase the amount of time they wear it. It may start off with trials during an afternoon nap or watching TV, perhaps. The goal is to keep it on overnight, or as prescribed.

E. BILEVEL UNITS

If your child has been prescribed a Bilevel unit from the VEP, there are 3 main devices that may be selected for therapy at home. With children, the device chosen must be approved based on a minimum weight requirement. This will ensure that the device can sense or detect your child's breathing efforts and have reliable alarms. Babies and children are currently prescribed one of the following:

- Philips Trilogy 200 is available for children greater than or equal to 5 kg[3]
- ResMed Stellar 150 is available for children greater than or equal to 13 kg[4]
- Philips BiPAP A40 is available for children greater than or equal to 10 kg[5]

Please note that even if your child is the appropriate weight to meet these requirements there are many other factors involved with choosing the best device for therapy. Your Respiratory Therapist, Respirologist and the Ventilator Equipment Pool will work together in collaboration with you and your child to ensure that your child's needs are met.

The following Bilevel units are provided by the VEP on a long-term loan for your child. The unit prescribed may be different from the units shown below.

www.ResMedS

Figure 3. ResMed Stellar 150.www.ResMedStellar.com

Figure 4. Philips Respironics BiPAP A40 with attached humidifier module www.eastin.eu/en/searches/products/detail/database-rehadat/id-IW_040312.250

F. BILEVEL PARTS

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

There are several different types of interfaces, or masks: masks for the nose, mouth, or nose and mouth. Mask choice is a personal choice. It will be up to you to determine the best mask to wear and this can be the most difficult part of the setup. 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 your child breathes out and it must never be blocked. Do not cover your baby or child’s face with a blanket or toy that could block the exhalation port.

Your child’s lung Doctor may prescribe a full-face mask (covers nose and mouth). For children who require a full-face mask and are not able to remove the mask themselves if they need to vomit, they will also be prescribed a saturation monitor and require close supervision overnight. Vomiting with a full face mask on can be very dangerous as the child could easily inhale (aspirate) the vomit.

Children on Bilevel by nasal or full face mask who are also G-Tube fed will require G-Tube venting more frequently overnight. This will prevent gas build up in their stomachs and keep them more comfortable with Bilevel therapy. Please avoid feeds just prior to bedtime and overnight if possible.

G. BILEVEL MODES

A mode is the method of how the ventilator delivers air and allows exhalation (breathing out). Your Respiratory Therapist and Respirologist will work together to determine which mode works best for your child. There are several common settings used when setting up a Bilevel unit. Typically, the modes used for Bilevel are:

1. Spontaneous Timed Mode (S/T)
   In this mode, when the child takes a breath, the machine will deliver the set IPAP pressure. If the child does not trigger a breath within a certain time frame, the machine will deliver a breath. The child's breathing efforts determine the start and end of the breath.

2. Pressure Control Mode
   In this mode, the machine will give the child a breath and cycle to exhalation after certain settings and pressures have been reached. The child can trigger a breath to start but the machine will determine when the breath ends.

H. BILEVEL SETTINGS

Settings can vary greatly from child to child and amongst different Bilevel units. Your child's settings will be determined by your Respiratory Therapist and Doctor based on the therapy and comfort level.

Fill in your child's Bilevel information below.

Make and Model is:

____

My Bilevel settings are:

Mode ______________________ Other Settings ____________
IPAP ______________________ ______________________
EPAP ______________________ ______________________
RR: ______________________ ______________________
Ti min-max ________________ ______________________
Rise ______________________ ______________________

I. BILEVEL ALARMS

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

- **Low Pressure Alarm**
  If there is a large leak, the machine will alarm to let you know so you can fix the leak.

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 5. 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]

The Trilogy 200 unit is also often prescribed for Non-invasive Ventilation in babies. It is safe for patients as small as 5 kg. Whereas, the Stellar is used for body weights greater than 13kg, and the A40: weights greater than 10kg. Please see the power sources for the Trilogy 200 unit as reviewed in **Section 4:E of Mechanical Ventilation**.

K. CLEANING

It is very important to keep all pieces of your Bilevel unit clean. You can help prevent your child getting lung infections by keeping the Bilevel unit, circuit, and mask clean. The tubing delivering the air to the mask and lungs may collect dust and even mold. The humidifier chamber is a good environment for germs to grow so it 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 and saliva from causing the mask plastic to break down which causes leaks. When the mask plastic breaks down, you tend to over-tighten the mask to the face to minimize the leaks. Over-tightening the mask causes 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 troubleshooting. We have included some common problems in the Troubleshooting chart below:

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)
Nose is stuffy or runny	Humidifier is not being	• 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	Mouth drops open when	• Consider adding a chin strap • Consider using a full face mask that covers your mouth

M. WHEN TO GET SUPPORT & CONTACT INFORMATION

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

My Respiratory Care Company is: ______________________________

Telephone number: ______________________________

My Respirology Clinic's Telephone Number: ______________________

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 your child is tolerating Bilevel therapy, call your Respirology clinic and speak with your Respiratory Therapist.

N. HOW DO I ORDER PARTS?

The Bilevel and the parts required to operate the unit (humidifier, battery, charger, and circuits) 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.

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4. 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

5. BiPAP A40 User Manual. Ontario Ventilator Equipment Pool Website. http://ontvep.ca/w/wp-content/uploads/2014/05/BiPAP_A40_User_Manual_International_English.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 your child has a neuromuscular disease or spinal cord injury and needs more breathing support during the day because of weak breathing muscles.

Taking a breath from the mouth-piece ventilator takes practice at first. Your child will learn how to put their lips firmly around the mouthpiece and, using the cheek muscles, sip air through the mouthpiece, like sipping water through a straw. The ventilator will know that they are there by sensing their ‘sipping,’ and deliver a breath. Your child may feel a gentle stretch in their chest before they exhale out to the room. Mouth-Piece Ventilation can be set up on your child’s 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 child’s quality of life as they can be more mobile in their daily life. They can experience normal speaking and eating habits.

It can be used for daily chest stretches, lung volume recruitment (LVR), and assist in making your child’s cough stronger.[2,3,4]

C. GETTING STARTED

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

If your child is using the Bilevel more and more during the daytime, your child may be a candidate for Mouth-Piece Ventilation. Speak to the Doctor or Respiratory Therapist if your child needs the 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 child's wheelchair if they will be using MPV during the day. The ventilator and its battery will require regular charging so it is always ready for use. Mounting the ventilator on the wheelchair requires assistance from your child's 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 your child qualifies, 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 will 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 setup and trial sessions.

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)]

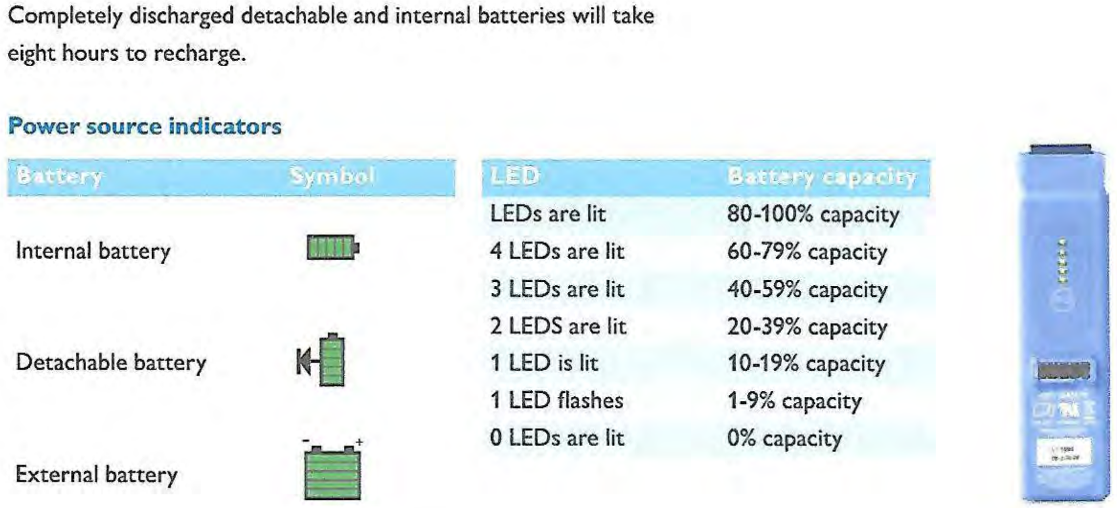
Figure 6. Philips Respironics Trilogy Ventilator https://images.philips.com/is/image/PhilipsConsumer/HC1040005-IMS-en_US

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

Figure 7. Power indicators and 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

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 child's 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)]

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

A battery is needed when you use your child's ventilator with your child's wheelchair. You will need to buy another battery for this purpose. Discuss this with your child's 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 child 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 child is unable to breathe on their own, help them breathe with the resuscitation bag 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 child 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 Doctor/Respiratory Therapist 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 your child's home ventilation equipment. As named, the bag can "self-inflate" and manually ventilate or push air into your child's 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 your child is having trouble breathing
- If the ventilator is not working or the power supply fails
- To support child before, during and after suctioning if needed[1]
- As part of lung volume recruitment exercises (see **Section 8: Lung Recruitment & Pulmonary Clearance Techniques**)

Choose the Correct Size!

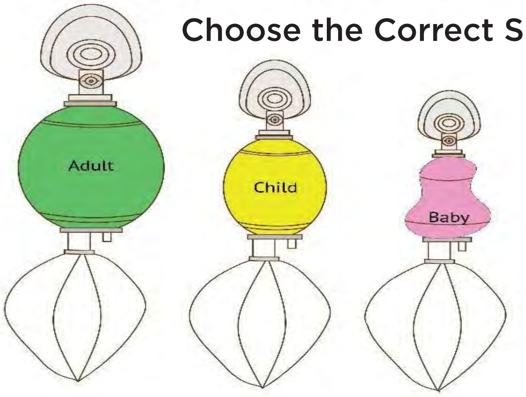


Figure 2. Manual Resuscitator Bags. Momomimee Shutterstock529599076

Manual resuscitation bags (Ambu bags) come in infant, child, and adult sizes, so make sure you are using the correct size for your child.

- Using a bag that is too large may cause injury
- Using a bag that is too small may not give your child the amount of air he/she needs.

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 child 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]
   - 20-30 times for a child[2]
   - 30-40 times for a baby[2]
5. If the child 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
- If possible, be sure the child is lying on his or her back
- If the child 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
    - 20-30 breaths per minute for an child
    - 30-40 breaths per minute for a baby
    - If the child starts to breathe, try to squeeze the bag as they breath 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 a single patient use 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. 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 child.

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 (make sure speaking valve is off before inflating 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 breath 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 further 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

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
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]
- Humidifiers are used to overcome dryness to the nasal passages caused by non-invasive ventilation. Constant flow of dry air through the nose and/or mouth may be irritating. Adding humidity 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)

A HME may also be called a Swedish Nose or artificial nose. 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 child 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

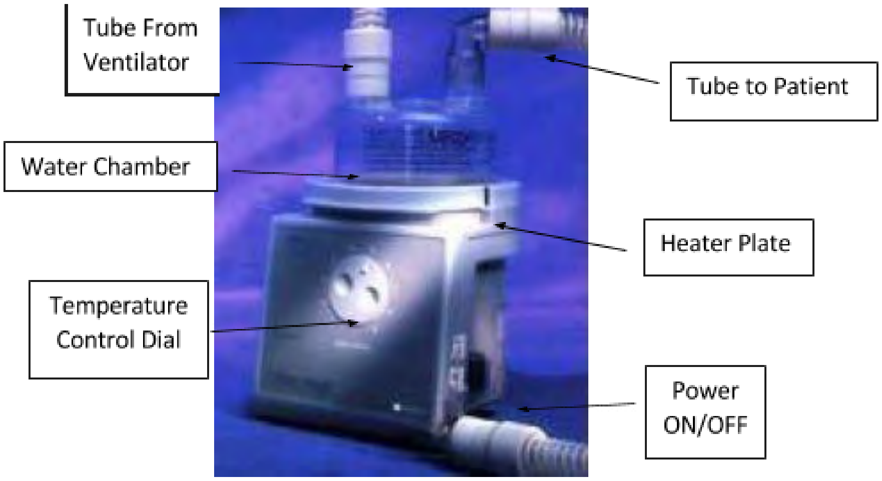


Figure 5 Fisher Paykel MR410 Humidifier http://www.medwow.com/med/nebulizer/fisher_paykel/mr410/18016.model-spec

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

D. PARTS OF THE HEATED WIRE CIRCUIT HUMIDIFIER

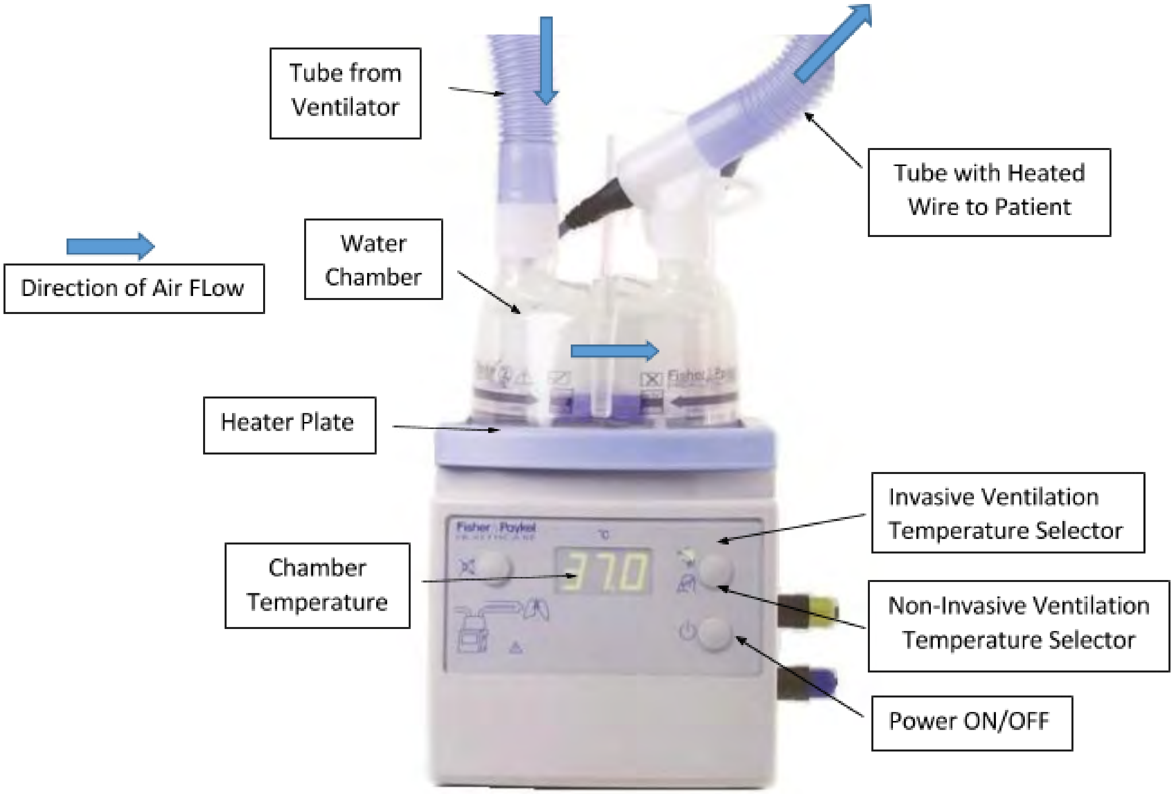


Figure 6. Fisher and Paykel MR850 Humidifier
http://bemeseast.com/index.php?route=product/product&product_id=180

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

There are different types of pass-over humidifiers.[1] Some ventilators have the humidifier built-in while others are 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. Removing the water trap will not create a leak in the circuit so manual ventilation will not be necessary.

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

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
   Manual Shelf Website Copyright 2014
2. www.manualshelf.com/manual/fisher-paykel/mr850/humidifier-user-manual/page- 12.html Accessed April 2017
3. Manual Shelf Website Copyright 2014
   www.manualshelf.com/manual/fisher-paykel/mr850/humidifier-user-manual/page- 23.html Accessed April 2017

Pulse Oximeters

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

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 Child's Normal $SpO_{2\ \text{range}}$ is: ______________________________(%)

My Child's Normal 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.

My child is 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

For those who qualify, the VEP provides an oximeter called the Massimo Rad-8 (see image below). Be sure to review your machine's User's Manual.

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

D. PARTS OF THE PULSE OXIMETER

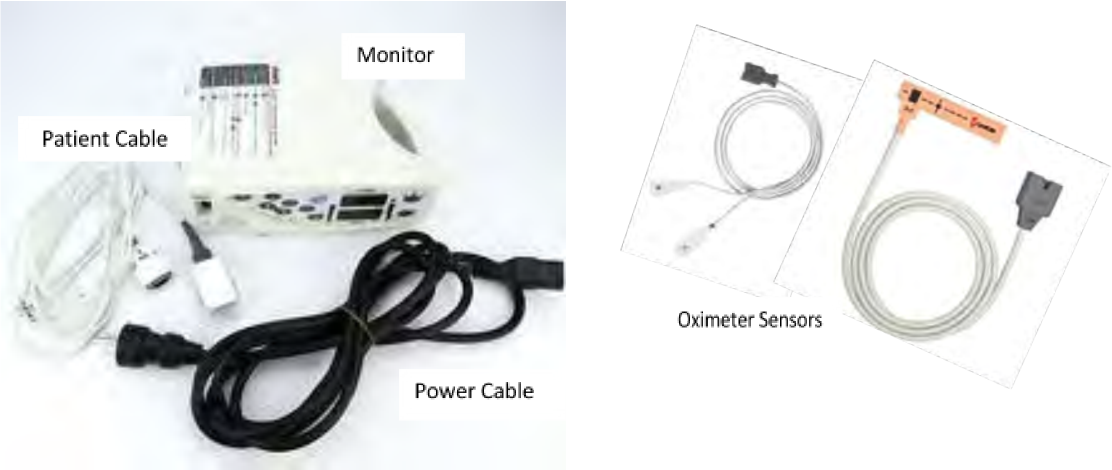


Figure 10. Massimo Rad8 Pulse Oximeter. www.colonialmed.com/images/Product/medium/7414.jpg

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

E. PULSE OXIMETER PARAMETERS

A typical prescription will give parameters or alarm settings to alert you to check your child. 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.

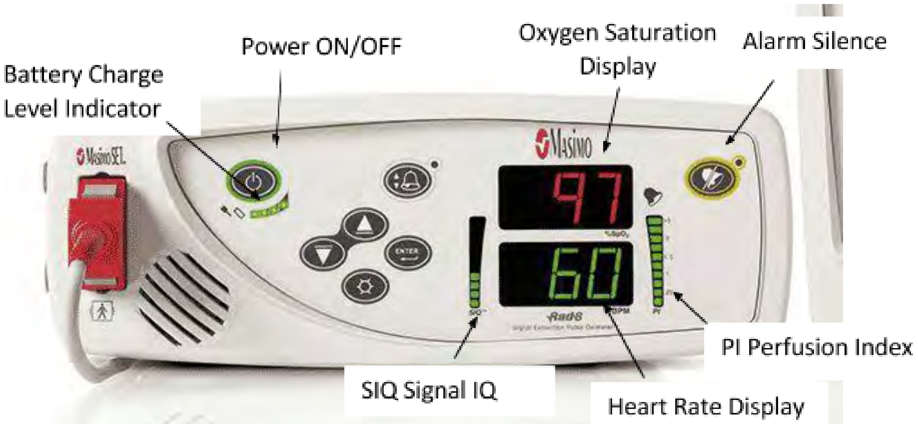


Figure 11. Masimo Rad8 Pulse Oximeter. www.dufortlavigne.com/en/produit/MAM9190

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 SpO_2 is not a good signal
- The Signal IQ bar indicator can be used to determine if the SpO_2 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 Likely 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.
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)

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

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 child is in no distress and looking well but SpO_2 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?
SpO2 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 suppl
	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. http://ontvep.ca/w/wp-content/uploads/2014/05/Masimo-Rad-8-User-Manual.pdf

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 Ventilator[1]?

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 make 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 keep your child's lungs clear, how to strengthen your child's cough, how to prevent mucus buildup in the lungs and how to prevent lung infections.

A. WHY IS LUNG RECRUITMENT & SECRETION CLEARANCE IMPORTANT?

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

A strong cough is important so your child can remove mucus from their lungs. If your child has weak respiratory muscles, they may not be able to cough out their 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 your child if their 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 child's cough. If these exercises are prescribed and performed daily, your child will be able move the mucus up from the airway into their throat or mouth where it can be suctioned. Doing these exercises daily will help keep your child's lungs clear and prevent mucus buildup and infection.

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 child's lungs feel full. LVR can be done with a mouthpiece, mask, or tracheostomy tube.

It is a useful tool for children with neuromuscular disease or spinal cord injury causing weak breathing muscles. Doing breath-stacking daily will allow you to increase your child's breath size beyond what they would be able to take in on their own. With this extra volume of air in their lungs, your child's cough will be stronger so they can clear their airways and prevent lung infections. The bigger breaths will also help them be able to blow their 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 your child has the following conditions:

- Asthma or a recent lung collapse (pneumothorax)
- Recent or ongoing vomiting
- Recent or ongoing coughing up of blood
- Your child has 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!

When Should You Do LVR Exercises

You can perform LVR exercises with your child anytime but a minimum of 2 times per day (ideally before meals) in the morning and again before bed.[2] You can do this more frequently if your child has signs of a cold, or if mucus is present, but no more than every 10 minutes to avoid dizziness.[1,2,3]

Equipment Required for LVR

- Self Inflating Resuscitation Bag (bag must be clearly identified NOT for Resuscitation/CPR)
- 50-100 cc corrugated tubing with one way valve attached
- One way valve connector with valve removed
- Mouthpiece and nose clip, connector to mask or connector to tracheostomy tube

How Do You Use The LVR Bag?

- Assemble necessary equipment.
- Have your child sit (or lie) as upright as possible in bed or in chair ensuring that the head is well supported.
- Work with your child to develop a signal that they can give you to indicate their lungs are full. Maintain eye contact throughout the exercise and always respond to this signal.
- Ask your child to breathe out completely.
- Have your child take the mouthpiece and encourage tight seal with lips. Nose clips may be required. (Option: Mask Interface, if not able to maintain seal with lips around mouthpiece)
- With clear verbal coaching, say “Breath IN.” As the child takes a breath in, coordinate with their breath and gently squeeze the bag. Assess for leaks throughout the maneuver.
- If you hear or notice a leak, or you are not able to achieve stacked breaths (child is exhaling and not allowing the breath in) then remove mask/mouthpiece, assess seal and start again.
- Once you have achieved a good seal, squeeze the bag 3-5 times until you feel that the lungs are full (assess chest expansion) or until your child indicates with a signal that you have created a good stretch across the chest.
- Encourage your child to hold the air in their lungs for a few seconds and cough forcefully once they can no longer hold air in.
- Repeat steps 4-10 three to five times.
- Wipe mask/mouthpiece with warm water and gentle soap to clean.

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

Mask may have a luer lock port on the mask cushion. Use a 10 or 20 cc syringe to ensure cushion is well inflated.
If cushion is not well inflated, you will not be able to achieve a good comfortable seal.
Talk to your Respiratory Therapist to ensure you have the correct size mask

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 your child's 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 (do NOT push mask onto face).
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 child's 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.

LVR With A Trach Tube

Your child can still receive LVR if they have a tracheostomy tube. However, there must be a leak around the tracheostomy tube and/or a cuff that is deflated before LVR exercises. It is important to have good communication and coordinate LVR with the child's breaths.

IMPORTANT! Remember, with LVR you are attaching a one-way valve to the tracheostomy tube and air flow out of the lungs is blocked! This is why there must be a leak around the trach or a deflated cuff.

A small leak around the tracheostomy tube allows for a safety "blow off" valve (pressure-relief) during stacked breaths to prevent air trapping and accidental over inflation of the lungs. You must be careful to watch the chest carefully for signs of over inflation.

Figure 4. Equipment for LVR via Tracheostomy Tube. Photo by Melissa Heletea

Performing LVR With A Tracheostomy Tube

- Assemble necessary equipment including portable suction and appropriately sized suction catheter.
- Have your child sit (or lie) as upright as possible in bed or in a chair ensuring that the head is well supported.

- **Verify that the tracheostomy tube is patent, or clear, and ensure that the cuff is DEFLATED (if applicable)**
- If possible, coordinate/ask your child to breathe out completely.
- Connect LVR circuit to tracheostomy tube.
- Gently squeeze the resuscitation bag, use clear verbal coaching “Breath IN” to coordinate squeeze with your child’s inspiration.
- If you are not able to achieve stacked breaths (child is exhaling/pushing against breath in) then remove circuit from tracheostomy tube and start again.
- Once you have coordinated a breath in together, squeeze the bag 3-5 times until you feel that the lungs are full (assess chest expansion, etc.) or until the patient indicates with a signal that you have created a good stretch across the chest.
- Encourage cough and suction tracheostomy tube as necessary.
- Repeat steps 4-10 three to five times as tolerated and as necessary to clear secretions.
- Disconnect trach adaptor and clean as necessary.
- Disconnect filter and replace filter as necessary.
- If applicable, re-inflate cuff.

Note: If your child is admitted to hospital, it is possible you may see the Respiratory Therapist perform LVR with cuff inflated. We do not prescribe this practice for home.

Please note that if your child qualifies for a cough assist device, your Respiratory Therapist can teach you a breath stacking technique that may be more comfortable for your child if they have a tracheostomy.

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, your child can only breathe in with the bag attached, they 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, your child can breathe in and out with it. This bag is to be used to help your child breathe during emergencies or difficulties catching their breath. Please note this difference and ensure everyone involved with the child’s care is aware of the differences![3](2)

IMPORTANT! Clearly mark the LVR Exercise Bag and Equipment **“NOT FOR RESUSCITATION”** and store separately from your emergency equipment.

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

Please note that there are some differences when performing LVR techniques with children versus adults. Both methods are effective. The Pediatric technique has been used to help children get used to the mask and be able to coordinate breaths with a coach. Do not be confused when viewing the CANVent videos.

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

Cough Assist Device What is the Cough Assist?

The Cough Assist, or "cough machine," uses mechanical power to help your child cough and bring up mucus from their lungs. You may hear it also called the mechanical insufflation-exsufflation machine (MI-E) or Coughalator. This device is helpful if your child has a neuromuscular respiratory muscle weakness or a spinal cord injury that limits the ability to cough well. The machine helps your child to cough secretions into the upper airway or tracheostomy tube so they can be easily cleared. This helps to avoid deep suctioning of the airway. It uses a mask, or trach connector, and breathing hose to Non-invasively fill both lungs with air until they are full and then quickly reverses the pressure to pull or "vacuum" the air and mucus from your child's 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. This device is used non-invasively, lowering the risk of damaging the wall of your child's lungs than regular suctioning.[1,5,6]

Your doctor will prescribe the Cough Assist machine and the Respiratory Therapist will set the machine up with your child's therapy and comfort in mind. If your child qualifies, 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 3. 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 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 child 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 Respiratory Therapist will determine the best mode for your child.

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 Respiratory Therapist. The goal is to get the best secretion clearance while keeping comfortable and safe settings.

How Do We Start Cough Assist Therapy With A Young Baby or Child?

- Before reviewing the treatment steps, it is important to recognize that a baby or young child will not understand the need for this therapy and may even be quite frightened by the sound of the unit itself.
- In emergency situations there may not be much time to explain and or allow the child to get used to the noise and or the feel of a mask pressed tightly to their face.
- As much as possible during admission and for discharge home it is best to work with the child and their ability to accept this therapy in a step wise approach.
- We know that each child is different; some may feel such a benefit that they can accept the therapy readily.
- The mouthpiece is generally more effective with older children who can maintain a tight seal and coordinate breathing when coached.

For babies and young children, we initiate LVR and cough assist with a mask.

Helpful Tips

- Introduce the mask and allow them to place on their own face or stuffed toy/doll's face.
- Try turning the machine on in the room for a while why they play with mask.
- Make pretend cough sounds with the machine on as you place mask on the stuffed toy/doll.
- Use lots of positive reinforcement and congratulate every effort they make to try mask. School-agers love sticker charts that show their progress.
- Babies and very small children feel less stressed when held or supported in a sitting position if possible when mask is applied to their face.
- You and the Respiratory Therapist will decide when it is time to attempt therapy with low pressure settings (initially).
- Your Respiratory Therapist will adjust pressures and settings on the cough assist machine as the child is able to tolerate. Note: this may happen during your child's first session or after months of sessions working together. Every child is different.

Figure 4. Cough Assist by mask. http://respicare.ph/product/coughassist-e70/

Cough Assist With A Mask

- Always ensure that you are using the correct preset prescription on your machine and that the pressure settings are correct.
- Use the cough machine for at least 2-3 therapy sessions per day with 3-5 insufflation-exsufflation cycles at each session. Use the Cough Assist more often during colds or congestion.
- Give your child short rest periods to avoid any dizziness. It is best to do this treatment before meals, unless it is an emergency.[4,5]
- The hardest part of the treatment will be keeping a tight seal with the mask against the face. See section above on how to troubleshoot mask seal for LVR.
- If there are leaks, the pressure will leak out around the mask and you will not get the correct amount of pressure and air delivered to your lungs.

Figure 5. Cough Assist E70 used through a trach
http://www.philips.ca/healthcare/product/HC1098159/cough-assist-e70-ventilation

Cough Assist With Tracheostomy Tube

- You can use the cough assist machine if your child has a tracheostomy.
- You will need a tracheostomy connector to attach the circuit to the end of the trach.
- Most children with tracheostomies at home do not have a cuff on their tracheostomy tube.

IMPORTANT! If your child does have a cuffed tracheostomy tube, consult your Doctor and Respiratory Therapist before using cough assist at home.

- 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 discarded if secretions are collected.
- Hold the tubing end like a pencil to allow for easy disconnection.[6]

Make eye contact with your child. Be sure to coach loud and clear during breath stacking “IN” and during exsufflation “COUGH”

Treatment Procedure in Auto Mode

1. Attach the mask or trach adapter to the circuit.
2. Press the Power On/Power Off button to turn the device on.
3. Check your settings before starting therapy.
4. Press the Therapy button to start therapy.
5. Attach the tracheostomy adapter to your child’s tracheostomy or place mask over your child’s mouth and nose to create a tight seal.
6. The device will automatically cycle from Inhale (positive pressure) to Exhale (negative pressure) and back to positive.

7. After the necessary cycles are completed, disconnect the cough assist circuit from the trach or remove the mask from your child's face.
8. Clear secretions that may have been brought upward into the mouth, throat, or tracheostomy tube.
9. Repeat therapy as recommended by your doctor.

Figure 6. 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 or 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 have Insufflation/Exsufflation (In/Ex) using the 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.

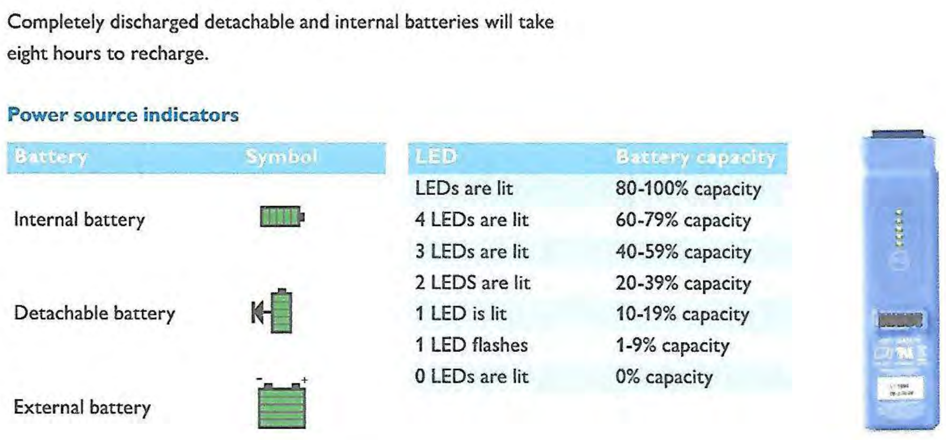
The Bacteria filter which must be used with a VEP Cough Assist unit can be left in place as long as it does not get wet or have any secretions in it. Do not wash this filter. It must be replaced as it is disposable.[6,7]

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 7. Power indicators and Trilogy detachable battery
http://www.philips.ca/b-dam/b2bhc/master/whitepapers/treating-restrictive-lung-disease-at-home/1061109_TrilogyWrk shpUS_Booklet.pd

How do I Order Parts?

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

D. SUCTIONING

This section will discuss suctioning in general, whether it is with secretion clearance techniques, such as LVR or Cough Assist, or suctioning as a stand-alone procedure.

i. When Do I Need To Suction?

Always be ready to assist your child with clearing secretions during any Lung Volume Recruitment exercise or Cough Assist session. Have the suction machine charged and ready during therapy.

Figure 8. Yankauer Suction Catheter and Suction Tubing www.melsonmedical.com/photo/pl1046901-yankauer_ suction_catheter_yankauer_suction_suction_catheter_suction_ tube.jpg

You may help them to clear oral secretion by using a yankauer or suction catheter. Try to avoid stimulating the gag reflex when suctioning the mouth by sliding the catheter along the side of the tongue and the cheek and to access the back of the throat.

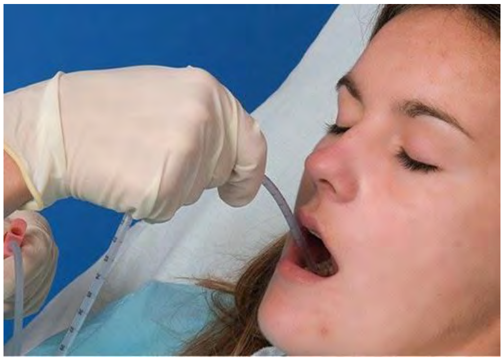


Figure 10. Oral Suctioning with Suction Catheter www.1.bp.blogspot.com/-q9hkT6GNbto/UsOsnCt76EI/ AAAAAAAAAW0/9hM6FE2E5vE/s1600/Oropharyngeal-suctio ning.jpg

Some children prefer to suction their own mouth during LVR or Cough Assist therapy. If they are able, allow them as it is much more comfortable.

Suctioning is a way to remove mucus from the mouth or trach tube and helps keep the airway clear so your child can breathe easily. Suctioning can also be done with smaller tubing called a 'catheter' placed inside the 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.

Aside from LVR and Cough Assist exercises, there are other instances when the child will need to be suctioned. Most children will get suctioned only 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 the daily routine. For example, your child's 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]

When Should I Suction?

- Only suction when needed.
- How often you need to suction will vary from child to child and will increase when your child is ill.
- Try to avoid suctioning too frequently.
- Your child's age and the reason they needed a tracheostomy will also determine how often your child needs to be suctioned.[12]
- A baby or toddler may need more frequent suctioning because of crying, a less efficient cough, and more frequent colds.
- An older child may need suctioning only occasionally when they are healthy and more often when he or she is sick.
- As you spend time with your child, you will come to know his/her normal breathing pattern. What you see, feel and hear will tell you when to suction your child.

Suctioning may be required if:

- Rattling mucus not cleared with coughing
- Bubbles of mucus at tracheotomy opening
- Dry raspy breathing or a whistling noise from tracheostomy
- Difficulty breathing (dyspnea)
- Faster rate of breathing
- Colour changes (pale skin, blueness of toes/fingers or around lips)
- Anxiety or restlessness
- Decreased breath sounds
- Older children may verbalize, or signal a need to be suctioned
- A drop in oxygen saturation
- Frightened look
- Flared nostrils (nostrils become wide)
- Clammy skin
- Decrease in chest rise for child on a ventilator

A suctioning routine could be:

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

Find a suctioning routine that works best for your child.

My suctioning routine is:

____

____

____

____

____

as needed.

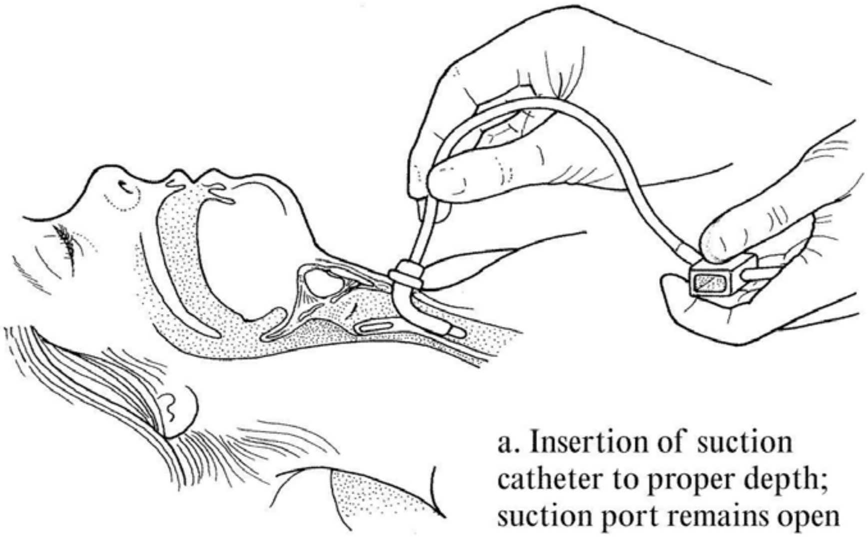
ii Setting-Up the Portable Suction Equipment

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 the child.[3(33-37), 9(7-8)]

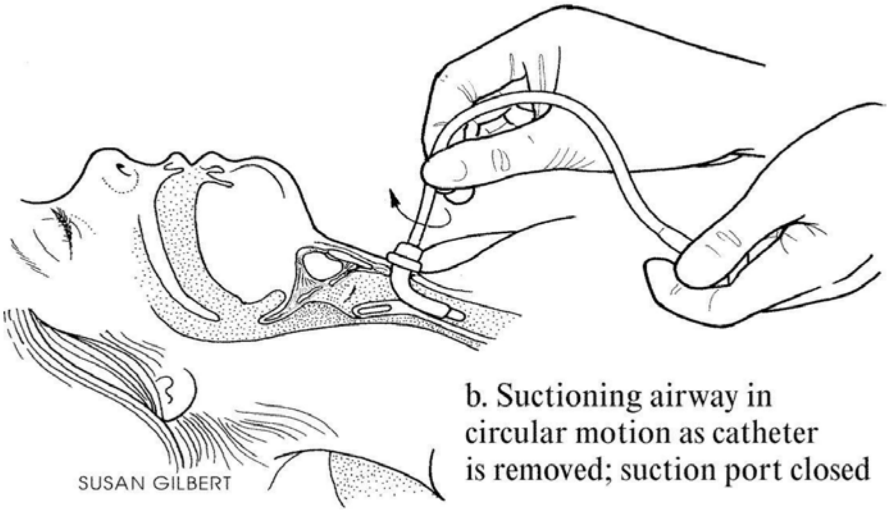
Figure 12. Devilbiss Home Suction Machine.
http://www.devilbisshealthcare.com/products/suction-therapy/homecare-suction-unit

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.

iii. Tracheal Suctioning



a. Insertion of suction catheter to proper depth; suction port remains open



b. Suctioning airway in circular motion as catheter is removed; suction port closed

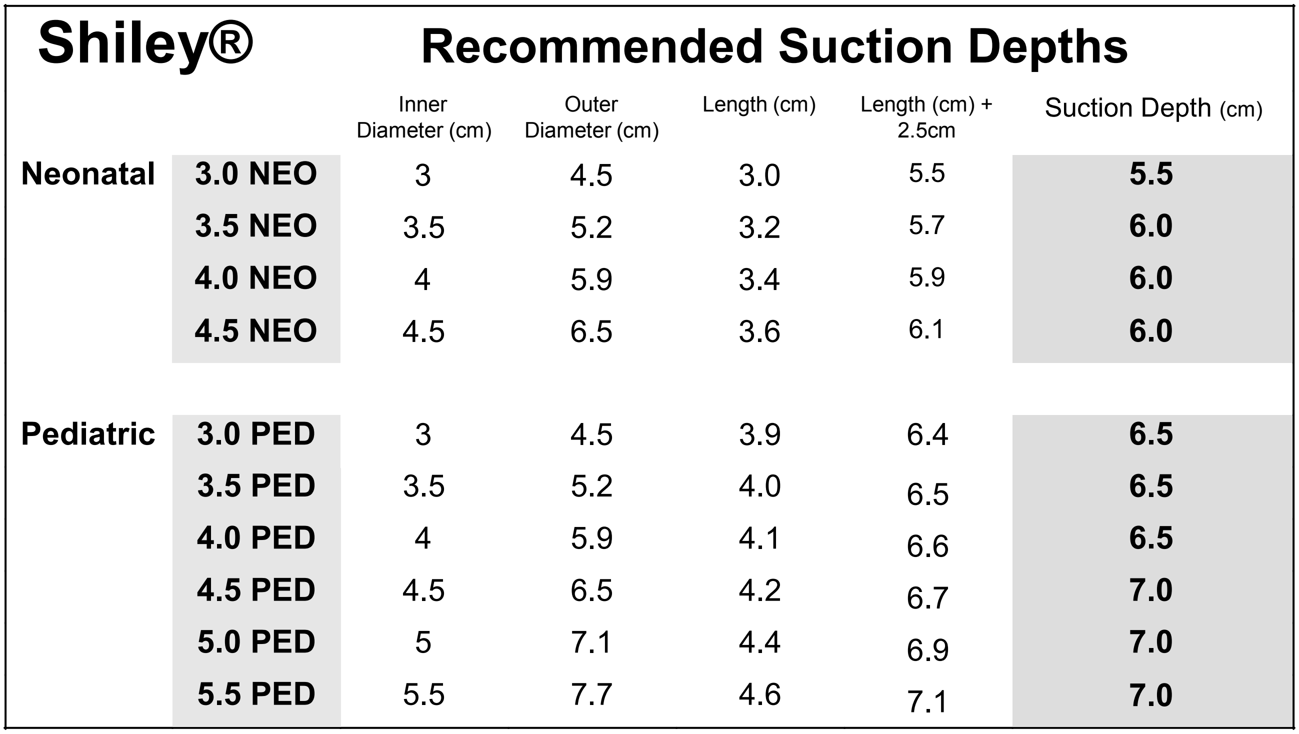
Figure 11 Suctioning Tracheostomy Tube
Used with Permission from Marc Tessier RN CHEO Tracheostomy Manual

How Do I Know How Far Down I Should Suction?

How deep you go with the suction catheter depends on the size of trach tube. The suction catheter should be put in 0.5 cm further than the length of trach tube. The obturator may be used as a measuring guide.

For a Shiley® tracheostomy tube, it is very easy to figure out how far you should suction. You simply add 2.5cm to the length of the tracheostomy tube written on the box.

To make it even easier, you can then round the number off to the nearest Ð cm.



Shiley® **Recommended Suction Depths**

		Inner Diameter (cm)	Outer Diameter (cm)	Length (cm)	Length (cm) + 2.5cm	Suction Depth (cm)
Neonatal	**3.0 NEO**	3	4.5	3.0	5.5	**5.5**
	3.5 NEO	3.5	5.2	3.2	5.7	**6.0**
	4.0 NEO	4	5.9	3.4	5.9	**6.0**
	4.5 NEO	4.5	6.5	3.6	6.1	**6.0**
Pediatric	**3.0 PED**	3	4.5	3.9	6.4	**6.5**
	3.5 PED	3.5	5.2	4.0	6.5	**6.5**
	4.0 PED	4	5.9	4.1	6.6	**6.5**
	4.5 PED	4.5	6.5	4.2	6.7	**7.0**
	5.0 PED	5	7.1	4.4	6.9	**7.0**
	5.5 PED	5.5	7.7	4.6	7.1	**7.0**

Figure 12. Shiley TT Recommended Suction Depths
Used with Permission from Marc Tessier RN CHEO Tracheostomy Manual

My suction unit pressure is to be set at: ________________________________
(Normal suction pressure: 80-100mmHg)

Size of suction catheters to be used is: ______________________________ Fr

The depth of my suction catheter is ____________cm (length of TT + 2.5 cm)

A Few Helpful Hints

Use your fingers as a guide. Many catheters come with measured markings on them. Place your fingers on the desired suction depth on the suction catheter and you can be assured that you will not go down the tube any further than you should.

If your suction catheters do not have measured markings, measure and cut a piece of tape If your suction catheters do not have measured markings, measure and cut a piece of tape which reflects the desired suction depth. Place that piece of tape on your child's suction machine or bedside. You now have a quick and easy reference tool to check your finger placement on the catheter.

Suctioning is considered a clean process and you want to keep the area and procedure as clean as possible. You do not want germs to enter into the trach as they can cause a lung infection. It is not a sterile process. You or the person doing the suctioning may wear masks and gloves so that the mucus and germs are not transferred to them[2(33-37),11(7-8)].

IMPORTANT! Check your suction equipment every day! It must always be ready-for-use in case of an emergency.

Tracheal Suctioning Supplies:

- 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

Technique for Suctioning a Trach

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

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

6. Hold the catheter at the desired suction depth

IMPORTANT! You do not want to go any further that 0.5cm past the end of the tube.

7. Remove the cork, trach mask, ventilator or manual resuscitator bag from the trach, if needed
8. Gently put the catheter to the depth determined for size of trach (0.5 cm longer than trach tube) 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.

9. If you hit resistance, pull back slightly
10. 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 pulling catheter out of trach tube

IMPORTANT! The suction catheter should not be in the trach for more than 15 seconds.

11. 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, remove it and use a new one.
12. If age appropriate, ask the patient “Do you need to be suctioned again?” Suctioning is needed if you hear “gurgling” sounds during breathing. Repeat as needed to clear secretions.

IMPORTANT! Suctioning can cause the child to feel very short of breath! Take breaks between suction attempts. You may need to place the child back on the ventilator for a while or give them some manual breaths with the resuscitation bag in between the suctioning sessions to relieve shortness of breath.

13. Look at the mucus being suctioned out. Take note of the amount, the colour, the thickness and the smell.
14. 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.
15. 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.
16. Turn off the suction unit.
17. Empty and clean the suction drainage bottles and containers, if needed.
18. Wash hands well.
19. 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. [2(33-37),11(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.

General 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 Ð 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. 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.

6. Rinse with clean, warm water.
7. 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 plugged, 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 My Child Feel Short Of Breath When He/She is Suctioned?

- When you are suctioned the procedure removes the mucus and some of the air from the lungs. Having air removed from the lungs can cause shortness of breath.
- For this reason try to keep the suction time to less than 15 seconds and rest between each attempt.
- You may also use a manual resuscitation bag to give breaths, before and after suctioning. This often helps the child feel less short of breath and may help move mucus further up the tube and easier to suction.

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 there was too much force when placing the suction catheter into the airway and trach tube.
- If you always gently insert the suction catheter into the trach tube you should not have any bleeding[2(36),11(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 to 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.

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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
  www.ventusers.org

Government Program

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

E. REFERENCES

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10. CAREGIVER'S ASSESSMENT

A THE IMPORTANCE OF THE CAREGIVER'S ASSESSMENT

- It is important to be able to recognize if your child is struggling to breathe. It can be a matter of life and death.
- Sometimes the child is able to tell us that they are having trouble breathing, and other times they are not able to tell what is wrong or 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 child is in respiratory distress and how to react initially. This section does not describe how to treat the child beyond the first few moments in a critical situation.

B. RECOGNIZING THERE IS A PROBLEM

- To recognize a problem, you must know your surroundings at baseline. This includes what the child's breathing looks and sounds like normally, noises in the home, breathing machine alarm sounds, the child's ways for showing he/she needs help, normal vital signs and normal sleeping habits or level of consciousness of the child, etc.
- When you sense a problem or hear alarms, first look at the child before going to assess the alarming breathing machine or any monitors. It can be tempting to run past the child and go directly to an alarming machine to see what all the alarming is about. However, sometimes the problem is with the child and you are wasting precious time with the machine.
- Generally, when someone is having trouble breathing, they will show signs that they have to work 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. CHILD COMMUNICATION DURING BREATHING DIFFICULTIES

- Some children can tell you what is wrong. Not all children are able to do so.
- Some children 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, children 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 child 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 CHILD IS HAVING TROUBLE BREATHING, YOU MAY NOTICE SOME OF THE FOLLOWING SIGNS AND SYMPTOMS:

Abnormal Vital Signs (On or Off the Ventilator)
- Increased breath rate (breathing faster)
- Increased Heart Rate
- Change in Body Temperature
- Drop in Oxygen Saturation Levels

If your child is having trouble breathing they may also show the following signs and symptoms:

- Coughing
- More secretions
- Short of breath at rest
- Working harder to breathe (nasal flaring, tracheal tug, indrawing of skin between and under the ribs)
- Appear to be using their belly to breathe
- Making grunting noises with each breath
- Look worried and scared
- Appear pale or even blue around the mouth and inside of lips
- More tired than normal and sleep more often
- Difficulty waking up, or may even complain of headache upon waking
- Uncomfortable lying down flat on their back (likely too short of breath to lie flat)

F. WHAT DO I DO IF THE CHILD 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 child.
   Quickly glance first from child's face and body, to child's airway, to the equipment (if child is on a machine) starting at the child and going to the machine.
   - Quickly scan the child's **face and body**
     - When you are looking at the child, 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 child's **airway**
    - When you glance at the airway (normal airway or tracheostomy tube) you are looking to see if it is open and clear.
    - For example, has the trach fallen out? Has the trach moved and is now blocked? Has the child vomited and is choking on the vomit?

- Then quickly glance at the **equipment, from the interface, circuit to the breathing machine.** When you glance from the airway to the breathing machine, you are looking for an equipment problem.
    - 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 obvious problems. You are not expected to find and solve the problem in the first scan. Your first priority is Airway and Breathing.

2. Manually ventilate the child right away, if needed. Do not delay manual ventilation to find out what the problem is.

    - 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 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 child is struggling to breathe. You should immediately begin helping the child 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

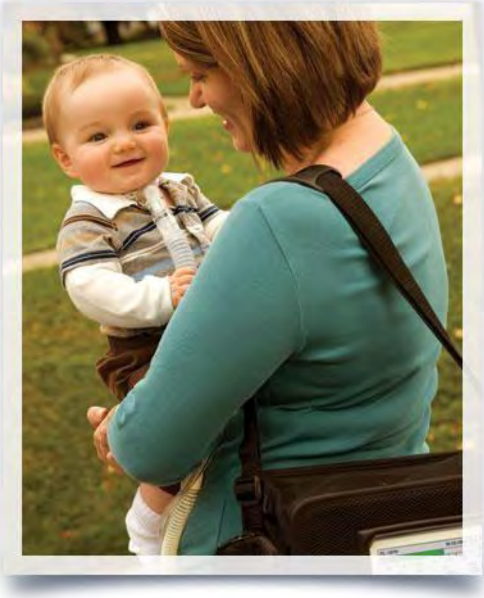

Figure 1. www.aeratech.com/portable-ventilators

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 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)
- 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 yankaurs 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 children 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 child, 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 child. Caregivers should have the opportunity to receive demonstrations and practice required skills in the hospital before going home with child.[1]

B. HOME TO DAYCARE OR SCHOOL

It is possible to be dependent on medical technology and still attend daycare or school. Families and caregivers 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 child's needs outside of the home. Schools are also able to support integration of children with complex medical needs through various resources and programs as well.[5,6] Families should contact their local daycare and school to identify the supports available and work with your medical team to determine a plan for these transitions. Be sure to activate this process at least a year in advance of planned daycare and or school start.

Families may also choose to Home school their children. Again, the local CCAC will help guide you through the available supports and resources to assist with you in this.

C. HOME TO HOSPITAL

Children 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 child's 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. TRANSITIONING FROM PEDIATRIC TO ADULT CARE

Transitioning from a pediatric to an adult care centre will present new changes and challenges. Independence is exciting for teenagers. The goal for the medical team is to provide you and your child with support, guidance, and reassurance that there will be no gaps in care during the transition to the adult health care system. It is beneficial for you to be involved and be an advocate for your child during these changes. As the child grows, they may become more and more involved with their own care and decision-making. This is good preparation for the adult world and adult health care system. Children transition to adult care once they reach the 18 years of age. Transition referrals and visits to adult care sites should start by age 17 to ensure a smooth transfer of care. Work with your medical team early so you and your teenager feel confident about the transition to the adult health care system when the time comes.

E. 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 child's 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 child's symptoms, and to improve the quality of your child's life. The Palliative Care team will be an "added care" and will work with your child's respiratory care team or any other team you are involved with to support you.[7] You can ask your child's Doctor to be referred to this team.

The best decisions are usually the most informed ones. It is important to start thinking about your child's end-of-life wishes before decisions need to be made in an emergency situation. Your child's end-of-life decisions are primarily yours and your child's to make but you should inform loved ones of the wishes and have a discussion with them about it. Make an effort to get to know what your child's options are. There are different care goals available and it is yours and your child's choice how much to be treated, how invasively, or non-invasively, and for how long. There is support available for whatever the care goals are. Ask your Doctor about your child's 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 loved ones and document the wishes with a living will or advanced directive. Living wills and advanced directives help guide the medical team when caring for your child and in emergency situations.[6]

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

F. 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

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

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

9. 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 Cardio respiratory 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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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